

# **EXHIBIT 1**

ZILLOW<sup>®</sup>GROUP

# Annual Report

2018



This annual report contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934 that involve risk and uncertainties, including the statements regarding our belief about our plans, objectives, expectations, strategies, intentions or other characterizations of future events or circumstances. Statements containing words such as “may,” “believe,” “anticipate,” “expect,” “intend,” “plan,” “project,” “will,” “projections,” “continue,” “business outlook,” “forecast,” “estimate,” “outlook,” “guidance,” or similar expressions constitute forward-looking statements. Differences in Zillow Group’s actual results from those described in these forward-looking statements may result from actions taken by us as well as from risk and uncertainties beyond our control. Factors that may contribute to such differences include, but are not limited to, those discussed under the heading “Risk Factors” in this Annual Report on Form 10-K for the fiscal year ended December 31, 2018, filed with the Securities and Exchange Commission, or SEC, and in our other filings with the SEC. Except as may be required by law, we do not intend, and undertake no duty, to update this information to reflect future events or circumstances.

# ZILLOW<sup>®</sup>GROUP

April 16, 2019

Dear Fellow Shareholders,

I am excited to return as CEO of Zillow Group at such a transformative time. The tides are shifting in real estate. Our world is being driven by “uberized,” on-demand consumers who have grown to expect magic happens with the simple push of a button. We’ve seen this in travel, ride hailing, car buying, shopping, streaming video, etc. The time for real estate is now and Zillow Group is leading the way.

In 2018, we made some bold moves to dramatically expand our business to meet these evolving consumer expectations. We are moving from an advertising-based online real estate marketplace for research and facilitating connections to one that also drives transactions. The successful execution of this transformation will substantially enhance the value we deliver to consumers and professionals throughout the entire home shopping life cycle, while dramatically expanding our market opportunity. Highlights from 2018 include:

- We launched Zillow Offers<sup>™</sup>, a fast-growing service in which we buy homes directly from consumers and then resell them on the open market. Consumer demand for this easy, low-hassle transaction is exceeding our expectations and, as I write this letter, Zillow Offers is live in nine markets, with plans to be in at least 14 by the end of 2019.
- We acquired Mortgage Lenders of America (MLOA), which has since been rebranded as Zillow Home Loans<sup>1</sup>, marking our entry into home loan originations and an important step toward delivering an integrated payments platform for Zillow Offers as a complement to our existing mortgage marketplace.
- We began transitioning our Premier Agent marketplace from a lead generation model to one that creates live on-demand connections designed to improve consumer satisfaction and deliver higher conversion rates for our Premier Agents. While we had some bumps in rolling this out initially, we made quick corrections and I am pleased to report our Premier Agent marketplace is normalizing. We also began testing new pricing programs designed to better align incentives and rewards with our agent and broker partners that we continue to evaluate.
- We made sizable investments to rewire the highly fragmented rental marketplace through technology and product innovation to make it easier for renters to search, tour, apply and pay rent for leased properties. At the same time, we are automating administrative services for property managers and landlords to make the entire property management process more efficient.

You will find more details about our financial performance in our Annual Report on Form 10-K. For my first letter since returning as CEO, I want to focus on our market expansion, near-term strategies, and long-term opportunity.

## **“Unsticking” Movers Ready for Real Estate 2.0**

We launched Zillow.com with the Zestimate<sup>®</sup> in 2006 because we wanted to empower consumers with information and radically improve the way people buy and sell homes. While one of our earliest ideas for Zillow involved auction-based home sales, we quickly realized the pre-smartphone world wasn’t quite ready for real estate e-commerce. The Zestimate became the backbone of our marketplace and launched us down the road of an advertising-based business model. Since then, we have built trusted

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<sup>1</sup> Zillow Home Loans is operated by Zillow Home Loans, LLC (NMLS #10287, an Equal Housing Lender)



brands with high awareness, grown the largest audience in the online real estate category<sup>2</sup>, designed powerful products and services, and earned revenue by connecting consumers with our strong network of industry professionals to guide them through their home shopping process. While we have made great strides in empowering and assisting consumers in this “search and find” era to create dreamers and would-be movers, this is only part of the equation. In today’s on-demand world, we must also radically streamline the real estate transaction. Consumers want this; and Zillow Group is sharply focused on leading them there.

It’s no surprise the norms of traditional real estate can actually stifle moving. The process can be daunting, complex, fragmented, and expensive. Case in point, nearly 180 million unique users visit Zillow Group’s mobile apps and websites each month<sup>3</sup>, and in 2018, 32 million Americans indicated that they intended to buy a home in the next 12 months<sup>4</sup> yet only about six million homes were purchased last year and another 10 million people entered into lease agreements.<sup>5</sup> That means there are still a lot of frustrated potential movers out there. It shouldn’t be that way. This pent-up mover demand gap is Zillow Group’s opportunity.

Real Estate 2.0 is about building on the transparency and progress over the past decade and removing the historical friction to make transactions more seamless and “unstuck” ready-to-move dreamers. With consumers as our north star, as they have always been, our purpose in this 2.0 world is to simply help people find a home they love and can afford, enabling moving as quickly and efficiently as possible.

### **The Power of the Zillow Group End-to-End Offering**

Zillow turned 13 in February, and since our initial launch, we have amassed significant competitive advantages to remove the traditional friction points of buying, selling, renting and financing. We’re leveraging our industry leadership, the power of the entire Zillow Group brand portfolio, our proprietary data and technology, our industry partnerships and our culture of innovation to nurture and grow our new and existing businesses. At the same time, we are partnering and evolving our relationships with Premier Agents and Brokers to delight our consumers, share in successes and set the stage for our next wave of mutual growth.

This evolution is designed to place Zillow Group at nearly every major point of the home shopping and transaction funnel to help consumers wherever they are in their mover lifecycle, enabling seamless transitions across our different business segments. We will continue to help dreamers search and find their next home, but now Zillow can also more directly help them buy, sell, rent and borrow, on their terms.

In Real Estate 2.0, moving will be easier. For renters, Zillow makes it easy to search and get into their new home faster through stored rental applications, credit and background checks and automated payments to get the attention of property managers and landlords quickly. For sellers, Zillow Offers addresses the uncertainty and hassle that can come with readying a home for sale by offering a fast, competitive price with a predictable close, eliminating the time and cost of appraisals, as well as the stress of living through home repairs and open houses. At the same time, this seller can now get pre-approved through Zillow Home Loans to help them simultaneously sell and buy, and get into their new home faster. They can also choose to buy their new home directly through Zillow or with the assistance of a Premier Agent. You can expect our future innovations will also address title and escrow to further reduce friction, increase speed and expedite more seamless transactions. Due to the end-to-end ease of working with Zillow and our network of agents and brokers, the next time a consumer — and their friends and family — are ready to move, we expect Zillow will be their first stop.

<sup>2</sup> Comscore Media Metrix® Multi-Platform, Real Estate, Total Audience, March 2019, U.S.

<sup>3</sup> Zillow Group internal, full year 2018 monthly average

<sup>4</sup> The Conference Board, Consumer Confidence Index, 2018

<sup>5</sup> U.S. Census Bureau and National Association of REALTORS® 2018; Zillow Group internal

## 2019 Imperatives Underpin Long-Term Targets

While 2018 was about pouring the foundation for our transformation toward transactions, in 2019 we are continuing the construction, making more investments to expand and grow our new and existing businesses. As we look ahead, you will see us sharply focused on execution, concentrating on a few key **imperatives**:

- **Accelerate Zillow Offers.** We have piloted and refined our playbook, and are now seeing consumer demand for fast, easy home selling dramatically exceeding our expectations. Already, we receive one seller request every five minutes, and we are gaining efficiencies along the way.
- **Build Zillow Home Loans as Zillow Offers Payment Platform.** We are deploying Zillow Home Loans as the featured payment option through Zillow Offers, driven by an experienced team who are working to significantly increase our loan origination volume and Zillow Offers attach rates over the next few years.
- **Evolve Premier Agent and Rentals to End-to-End, Success-Based Service Offering.** As we evolve Real Estate 2.0, we plan to continue to evolve the relationships we have with real estate agents, brokers, property managers and landlords from an advertising-based lead generation model to success-based partnerships in which incentives and rewards are better aligned in servicing and delighting our shared on-demand consumers through streamlined processes. We've already started in rentals and will continue to test alternate success-based pricing models with agents and brokers in select markets. This transition will take time, and we are not anticipating any meaningful revenue from this evolution until 2020 at the earliest.

These three **imperatives** will be supported by three **core operating fundamentals**:

- **Build World-Class Operations.** Moving from a media model to building success-based models to facilitating transactions and running end-to-end operations requires new muscles, talent and discipline. We have been making investments in building internal systems and infrastructure to operate these new businesses at scale, while also welcoming several key executive and team hires over the past year from places like Amazon, Google, Starbucks, Microsoft, and Invitation Homes.
- **Invest in Brand, Audience and Engagement.** We know that brands matter and Zillow now has more than 50 percent unaided awareness in the U.S.<sup>6</sup> We expect to leverage our large audience to keep our customer acquisition costs low and better serve consumers, helping them seamlessly navigate the home-related transaction process.
- **Invest in Culture of Innovation and Performance.** A long-standing competitive advantage at Zillow Group is attracting and retaining top talent with our inclusive culture that is frequently recognized by third parties. As we scale and invest in our existing and new businesses, we don't just want to maintain our great culture, we strive to make it world class, perpetuating innovation and driving results across our businesses to never stand still.

Through the successful execution of these imperatives and our long-term growth strategy, we believe we can achieve the following targets within three to five years:

## Homes Segment

- Purchase 5,000 homes per month through Zillow Offers, generating annualized revenue of approximately \$20 billion, up from 686 homes purchased in 2018, which generated \$52 million in revenue.

<sup>6</sup> Zillow Group internal, December 2018

**Mortgages Segment**

- Zillow Home Loans achieves a 33 percent attach rate to Zillow Offers, up from zero in 2018.
- Zillow Home Loans originates more than 3,000 loans per month, up from nearly 4,000 MLOA loan originations in all of 2018.

**Internet, Media & Technology Segment**

- Achieve more than \$2 billion in annual revenue, nearly doubling from 2018 results.
- Generate approximately \$600 million in annual Adjusted EBITDA<sup>7</sup>, or 30 percent of revenue.

While some might see these targets as significant, we believe these are within our reach.

**Our Expansion, Your Investment**

As a shareholder, you made an investment in Zillow Group, and I know we changed some of our fundamentals in 2018 that diluted our high-margin advertising business with lower-margin, capital-intensive transaction-based businesses. As your fellow shareholder, I understand this has been unsettling. It was for us as well, initially.

In his first-ever Amazon shareholder letter, Jeff Bezos shared his management and decision-making approach with investors saying, *"We will make bold rather than timid investment decisions where we see a sufficient probability of gaining market leadership advantages."* While we probably haven't articulated this as clearly, we operate under the same philosophy. I also realize that we can improve in our investor and shareholder communication to ensure you understand our rationale and thought processes behind the bold moves we are making and you will see us direct more attention here in 2019 and beyond. As a step in this direction, the longer-term targets we shared are intended to help you better understand what we see as the much bigger market opportunity. We understand the effects of our 2018 investments will take some time to materialize, but I believe we are absolutely moving in the right direction.

Consumers are already headed to Real Estate 2.0 and Zillow Group is uniquely positioned to lead them, leveraging our team, audience and portfolio to capitalize on this rising demand. During our first 13 years as a company, we captured nearly 10 percent of the total \$17 billion addressable market (TAM) for real estate advertising.<sup>8</sup> Now that we are transforming how people buy, sell and rent homes as we move our focus to driving more transactions, our TAM is expanding to the more than \$1 trillion in annual transaction value.<sup>9</sup> Today we are capturing less than 1 percent of this opportunity.

If we execute on our strategy as we have done since our inception, the opportunity available to us is quite large. While some industry leaders, or incumbents, can become complacent, at Zillow Group we have been at the forefront of innovation since our inception and are rediscovering our revolutionary mindset. The seeds of our new businesses we planted in 2018 are taking root. There is an energy and excitement in the halls of Zillow Group that comes from operating like a start-up again, but with the

<sup>7</sup> Adjusted EBITDA is a non-GAAP financial measure; it is not calculated or presented in accordance with U.S. generally accepted accounting principles, or GAAP, and should not be considered in isolation or as a substitute for our financial results as reported under GAAP. Zillow Group has not provided a quantitative reconciliation of forecasted segment Adjusted EBITDA to forecasted segment GAAP income (loss) before income taxes because the company is unable, without making unreasonable efforts, to calculate certain reconciling items with confidence. For additional important information, please refer to Exhibit 99.2 to our Current Report on Form 8-K filed with the Securities and Exchange Commission on February 21, 2019 and available on the Zillow Group Investor Relations website at <https://investors.zillowgroup.com/financials/sec-filings/default.aspx>.


<sup>8</sup> Borrell Associates 2018; Total spent on online and offline residential real estate advertising.

<sup>9</sup> Zillow Group internal estimate: \$900 billion home transaction value + \$87 billion agent commissions + \$45 billion property management spending + \$44 billion mortgage origination fees.

stability of size, scale and wisdom that comes with experience. I have never been more excited about our opportunities ahead and am personally energized to lead as CEO through this transformational period.

On behalf of the entire team at Zillow Group — who are your fellow shareholders — and our board of directors, thank you for your continued support and feedback, and for joining us on this journey to remove friction in real estate and ultimately help more consumers find a home they love.

Sincerely,

A handwritten signature in black ink, appearing to be 'RB' with a stylized flourish extending from the end.

Rich Barton

Co-founder & Chief Executive Officer



**UNITED STATES  
SECURITIES AND EXCHANGE COMMISSION**  
Washington, D.C. 20549

**Form 10-K**

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2018

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

Commission File Number 001-36853

**ZILLOW GROUP, INC.**

(Exact name of registrant as specified in its charter)

Washington  
(State or other jurisdiction of  
incorporation or organization)

1301 Second Avenue, Floor 31,  
Seattle, Washington  
(Address of principal executive offices)

47-1645716  
(IRS Employer  
Identification No.)

98101  
(Zip code)

(206) 470-7000

@ZillowGroup

(Registrant's telephone number, including area code)

Securities registered pursuant to Section 12(b) of the Act:

Class A Common Stock, par value \$0.0001 per share

Class C Capital Stock, par value \$0.0001 per share

(Title of each class)

The Nasdaq Global Select Market

The Nasdaq Global Select Market

(Name of each exchange on which registered)

Securities registered pursuant to Section 12(g) of the Act:

None

Indicate by check mark whether the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act: Yes ☒ No ☐

Indicate by check mark whether the registrant is not required to file reports pursuant to Section 13 or 15(d) of the Act: Yes ☐ No ☒

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☒ No ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☒ No ☐

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company" and "emerging growth company" in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer ☒

Non-accelerated filer ☐

Accelerated filer ☐

Smaller reporting company ☐

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act): Yes ☐ No ☒

As of June 30, 2018, the last business day of the Registrant's most recently completed second fiscal quarter, the aggregate market value of the Registrant's Class A common stock and Class C capital stock held by non-affiliates based upon the closing price of such shares on The Nasdaq Global Select Market on such date was \$10,442,769,057.

As of February 15, 2019, 58,111,740 shares of the Registrant's Class A common stock, 6,217,447 shares of Class B common stock and 140,268,416 shares of Class C capital stock were outstanding.

**DOCUMENTS INCORPORATED BY REFERENCE**

The information required by Part III of this Report, to the extent not set forth herein, is incorporated in this Report by reference to the Registrant's definitive proxy statement relating to the 2019 annual meeting of shareholders. The definitive proxy statement will be filed with the Securities and Exchange Commission within 120 days after the end of the 2018 fiscal year.

**ZILLOW GROUP, INC.**  
**Annual Report on Form 10-K**  
**for the Fiscal Year Ended December 31, 2018**  
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As used in this Annual Report on Form 10-K, the terms “Zillow Group,” “the Company,” “we,” “us” and “our” refer to Zillow Group, Inc., unless the context indicates otherwise.

#### **NOTE REGARDING FORWARD-LOOKING STATEMENTS**

This Annual Report on Form 10-K, including the sections entitled “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” “Risk Factors” and “Business,” contains forward-looking statements based on our management’s beliefs and assumptions and on information currently available to our management. Forward-looking statements include all statements that are not historical facts and generally may be identified by terms such as “believe,” “may,” “will,” “estimate,” “continue,” “anticipate,” “intend,” “could,” “would,” “project,” “plan,” “expect” or the negative or plural of these words or similar expressions.

These forward-looking statements are subject to a number of risks, uncertainties and assumptions, including those risks, uncertainties and assumptions described in Part I, Item 1A (Risk Factors) of this report. Moreover, we operate in a very competitive and rapidly changing environment. New risks emerge from time to time. It is not possible for our management to predict all risks, nor can we assess the effect of all factors on our business or the extent to which any factor, or combination of factors, may cause actual results to differ materially from those contained in any forward-looking statements we may make. In light of these risks, uncertainties and assumptions, the forward-looking events and circumstances discussed in this report may not occur and actual results could differ materially and adversely from those anticipated or implied in the forward-looking statements.

You should not rely on forward-looking statements as predictions of future events. Although we believe that the expectations reflected in the forward-looking statements are reasonable, we cannot guarantee that the future results, levels of activity, performance or events and circumstances reflected in the forward-looking statements will be achieved or occur. Moreover, except as required by law, neither we nor any other person assumes responsibility for the accuracy and completeness of the forward-looking statements, and we undertake no obligation to update publicly any forward-looking statements for any reason after the date of this report to conform these statements to actual results or to changes in our expectations.

## PART I

### Item 1. Business.

#### Mission

Our mission is to build the largest, most trusted and vibrant home-related marketplace in the world.

#### Overview

Zillow Group, Inc. operates the largest portfolio of real estate and home-related brands on mobile and the web which focus on all stages of the home lifecycle: renting, buying, selling and financing. Zillow Group is committed to empowering consumers with unparalleled data, inspiration and knowledge around homes and connecting them with great real estate professionals. The Zillow Group portfolio of consumer brands includes Zillow, Trulia, Mortgage Lenders of America, StreetEasy, HotPads, Naked Apartments, RealEstate.com and Out East. In addition, Zillow Group provides a comprehensive suite of marketing software and technology solutions to help real estate, rental, and mortgage professionals maximize business opportunities and connect with millions of consumers. Beginning in April 2018, Zillow Offers provides homeowners in certain metropolitan areas with the opportunity to receive offers to purchase their home from Zillow. When Zillow buys a home, it makes certain repairs and lists the home for resale on the open market. In October 2018, we completed the acquisition of Mortgage Lenders of America, L.L.C. (“MLOA”), a licensed mortgage lender, through which we originate residential mortgages to consumers. Zillow Group operates a number of business brands for real estate, rental and mortgage professionals, including Mortechn, dotloop, Bridge Interactive and New Home Feed. Zillow, Inc. was incorporated as a Washington corporation in December 2004, and we launched the initial version of our website, Zillow.com, in February 2006. Zillow Group, Inc. was incorporated as a Washington corporation in July 2014 in connection with our acquisition of Trulia. Upon the closing of the Trulia acquisition in February 2015, each of Zillow and Trulia became wholly owned subsidiaries of Zillow Group.

Our living database of approximately 110 million U.S. homes, including homes for sale, homes for rent and homes not currently on the market, attracts an active and vibrant community of users. Individuals and businesses that use Zillow’s mobile applications and websites have updated information on more than 80 million homes, creating exclusive home profiles not available anywhere else. These profiles include detailed information about homes, including property facts, listing information and purchase and sale data. We provide this information to our users where, when and how they want it, through our industry-leading mobile applications and websites. Using complex, proprietary automated valuation models, we provide current home value estimates, or Zestimates, and current rental price estimates, or Rent Zestimates, on approximately 100 million U.S. homes.

For the year ended December 31, 2018, we generated revenue of \$1,333.6 million, as compared to \$1,076.8 million for the year ended December 31, 2017, an increase of 24%. We generate revenue from the sale of advertising services and our suite of marketing software and technology solutions to businesses and professionals primarily associated with the residential real estate, rental and mortgage industries. We also generate revenue through the resale of homes on the open market through our Zillow Offers program which was announced in April of 2018, as well as through mortgage originations through our October 2018 acquisition of MLOA, a licensed mortgage lender.

As of the second quarter of 2018, Zillow Group had two reportable segments: the Internet, Media & Technology (“IMT”) segment, our historical operating and reportable segment, and the Homes segment. In our IMT segment, we generate revenue from the sale of advertising services and our suite of marketing software and technology solutions to businesses and professionals primarily associated with the residential real estate, rental and mortgage industries. These professionals include real estate, rental and mortgage professionals and brand advertisers. The four revenue categories within our IMT segment are Premier Agent, Rentals, Mortgages and Other.

Premier Agent revenue is generated by the sale of advertising under our Premier Agent and Premier Broker programs, which offer a suite of marketing and business technology products and services to help real estate agents and brokers achieve



their advertising goals, while growing and managing their businesses and brands. We primarily offer our Premier Agent and Premier Broker advertising products on a cost per impression basis. Impressions are delivered when a sold advertisement appears on pages viewed by users of our mobile applications and websites. Rentals revenue primarily includes advertising sold to property managers and other rental professionals on a cost per lead, cost per click, cost per impression or cost per lease generated basis, and beginning in 2018, it includes revenue generated through our rental applications product. Rentals revenue also includes revenue generated through our StreetEasy products and services, which is primarily generated on a cost per listing basis. Mortgages revenue primarily includes advertising sold to mortgage lenders and other mortgage professionals on a cost per lead basis, including our Connect (formerly known as Long Form) and Custom Quote services, as well as revenue generated by Mortech, which provides subscription-based mortgage software solutions, including a product and pricing engine and lead management platform. Beginning in the fourth quarter of 2018, mortgages revenue also includes revenue generated from mortgage originations and the sale of mortgages on the secondary market through our acquisition of MLOA. Other revenue primarily includes revenue generated by new construction and display, as well as revenue from the sale of various other advertising and business software solutions and services and technology solutions for real estate professionals, including dotloop. New construction revenue primarily includes advertising services sold to home builders on a cost per residential community basis. Display revenue primarily consists of graphical mobile and web advertising sold to advertisers promoting their brands on our mobile applications and websites.

In our Homes segment, we generate revenue from the resale of homes on the open market through our Zillow Offers program. We began buying homes through the Zillow Offers program in April of 2018. We began selling homes in July of 2018.

On October 31, 2018, we completed the acquisition of MLOA, a licensed mortgage lender. This acquisition is consistent with our strategy of moving further down funnel and closer to the real estate transaction to create better consumer experiences. The total purchase price for the acquisition of MLOA was approximately \$66.7 million in cash.

Beginning with the Quarterly Report on Form 10-Q for the quarterly period ending March 31, 2019, Zillow Group expects to report financial results for three reportable segments: the IMT segment, the Homes segment and the Mortgages segment. The IMT segment will include the financial results for the Premier Agent, Rentals and new construction marketplaces, as well as dotloop, display and other advertising and business software solutions. The Homes segment will include the financial results from Zillow Group's buying and selling of homes directly. The Mortgages segment will include the financial results for advertising sold to mortgage lenders and other mortgage professionals, mortgage originations through MLOA and the sale of mortgages on the secondary market, as well as Mortech mortgage software solutions. We expect the Mortgages segment, with the inclusion of MLOA, to have a material impact on our consolidated balance sheets, statements of operations and cash flows in 2019.

Portions of our business may be affected by seasonal fluctuations in the residential real estate market, advertising spending, and other factors. We believe our rapid growth may be masking the underlying seasonality of our business. As we continue to expand our Zillow Offers service, we expect seasonal variances may become more pronounced, causing our operating results to fluctuate. For example, costs and expenses typically peak in the three months ended June 30th, primarily attributable to increases in sales and marketing expenses which are, in turn, primarily attributable to increased investment in marketing and advertising initiatives to attract consumers across online and offline channels during peak seasons for home sales activity. For the year ended December 31, 2018, costs and expenses peaked in the three months ended September 30th, primarily attributable to the addition of our Homes business. In addition, the average number of unique users and visits have historically peaked during the three months ended June 30th or September 30th, also consistent with peak residential real estate activity in the spring and summer months. Because the number of unique users and visits may impact impression inventory, leads to real estate professionals, and graphical display inventory that we monetize, this trend in the average number of unique users and visits may result in seasonality of revenue. Also, as our Homes business revenue depends in part on users accessing our mobile applications and websites to engage in the sale and purchase of homes with Zillow Group on the open market, the impact of increased real estate activity in the spring and summer months may result in seasonality of revenue.

## Industry Dynamics

### *The Importance of Homes*

Homes are the center of peoples' lives, the focus of some of their most important decisions and often their most valuable assets. In addition to whether to buy, sell or rent, consumers frequently make many other important home-related decisions, including decisions relating to home financing and home equity loans. Residential real estate is one of the largest sectors of the U.S. economy and supports millions of professionals that provide services related to home purchases and sales, rentals and home financings.

### *Large Market Opportunities*

Based on external and internal assessments, we believe our current addressable markets include the following:

*Purchase and Sale*—In the United States, there are 212.8 million people residing in owner-occupied housing, according to data published by the U.S. Census Bureau in November 2018. Approximately 34% of movers in 2018, or 10.9 million people, were homeowners, according to the U.S. Census Bureau migration data published in November 2018.

Sales of approximately 5.4 million existing and over 600 thousand new homes in the United States in 2018 had an aggregate transaction value of approximately \$1.8 trillion, according to data published in 2018 by the U.S. Census Bureau and in 2019 by the National Association of REALTORS®. Estimated real estate commission revenue was approximately \$87 billion in 2018, according to data from REAL Trends in 2017, and data published in 2018 by the U.S. Census Bureau, and in 2019 by the National Association of REALTORS®. In an effort to acquire new client relationships and sell homes, U.S. real estate agents and brokers will spend an estimated \$8.3 billion on residential advertising in 2019, based on the most recent forecast from Borrell Associates released in 2019. In addition, U.S. real estate developers will spend an estimated \$715 million on residential advertising in 2019, also based on the most recent forecast from Borrell Associates released in 2019.

Based on current purchase criteria, which considers home value, square footage, year built and other parameters, if Zillow Offers were available in the top 200 metro areas in the U.S., sellers of nearly half of the existing homes sold in 2018 across the entire nation, or approximately 2.7 million homes, would have been eligible to receive offers from Zillow to buy their home.

*Home Financing*—According to a forecast from the Mortgage Bankers Association published in January 2019, approximately 4.2 million U.S. residential mortgage purchase originations occurred in 2018 for a total value of \$1.2 trillion. Based on quarterly performance data released by the Mortgage Bankers Association, estimated annual production revenue by purchase loan originators was approximately \$44 billion in 2018. U.S. residential mortgage providers will spend approximately \$7.1 billion in 2019 marketing their services and loan products to mortgage borrowers, based on the most recent forecast from Borrell Associates released in 2019.

*Rentals*—In the United States, there are 106.5 million people residing in rental housing units, according to data published by the U.S. Census Bureau in 2018. Approximately 66% of movers in 2018, or 21.4 million people, were renters, according to the U.S. Census Bureau migration data published in November 2018.

In the third quarter of 2018, there were approximately 46.8 million rental housing units in the United States, with a national vacancy rate of 7.1%, according to data published by the U.S. Census Bureau in October 2018. According to data published by the U.S. Census Bureau from the 2015 Rental Housing Finance Survey, approximately:

- 26.8% of rental units (12.5 million) are located in buildings with 50 or more units;
- 8.6% of rental units (4.0 million) are located in buildings with 25 to 49 units;
- 10.4% of rental units (4.9 million) are located in buildings with 5 to 24 units;
- 13.7% of rental units (6.4 million) are located in small multi-family structures of 2-4 units;
- 40.6% of rental units (19.0 million) are 1-unit structures.

According to an IBISWorld industry report on property management in the United States published in 2018, residential landlords spend an estimated \$44.0 billion on property management services annually. Based on the most recent forecast from Borrell Associates released in 2019, U.S. rental property managers will spend an estimated \$2.7 billion on advertising in 2019, which excludes lease concessions.

### ***Highly Fragmented, Local and Complex Market***

The market for residential real estate transactions and home-related services is highly fragmented, local and complex. Each home has unique characteristics, including location, value, size, style, age and condition. Each consumer approaches home-related transactions with a personal set of objectives, priorities and values. Real estate professionals generally operate in local markets, often as independent contractors with different experiences and skills. These conditions create challenges for consumers and real estate, rental and mortgage professionals alike. Consumers are challenged to find information about homes and to find real estate, rental and mortgage professionals who fit their individual needs. Real estate, rental and mortgage professionals are challenged to efficiently advertise their services and identify new clients, nurture those clients through transactions, and to measure the effectiveness of their marketing efforts.

### ***Preeminent Role of Mobile Devices in Lives of Consumers***

Consumers are increasingly turning to mobile devices to access real estate information and services via the internet, as well as to complete transactions. With the widespread adoption of mobile and location-based technologies, consumers increasingly expect home-related information and the ability to transact to be available via their mobile devices where, when and how they want it. According to Comscore data published in December 2018, Zillow Group brands represent nearly three quarters of market share of all mobile exclusive visitors to the real estate category. More than two-thirds of our flagship brand Zillow's usage occurs on a mobile device. We believe that the technological platform shift from desktop computers to mobile devices benefits technology leaders like Zillow Group that are quick to innovate.

### **Competitive Advantages**

We believe we have the following competitive advantages:

- *Powerful Brand and Scale.* We have established a powerful brand identity that includes a portfolio of the largest and most vibrant brands, and we have built a large user community. The majority of our traffic comes direct, not dependent on search engines, with demonstrated consumer intent to visit Zillow Group's brands. Traffic to Zillow Group brands' mobile applications and websites reached a seasonal peak of more than 195 million monthly unique users in July 2018, an increase of 4% year over year. Visits to Zillow Group brands' mobile applications and websites, including Zillow, Trulia, StreetEasy and RealEstate.com, increased 14% to 7,182.1 million for the year ended December 31, 2018 compared to the year ended December 31, 2017. For additional information regarding unique users and visits, see "Unique Users" and "Visits" in "Management's Discussion and Analysis of Financial Condition and Results of Operations."
- *Inimitable Database of Homes.* Our living database of homes is the result of years of substantial investment, sophisticated economic and statistical analysis, complex data aggregation and millions of user contributions. Our dynamic and comprehensive living database includes detailed information on more than 110 million U.S. homes, and includes homes for sale by third party sellers, homes for sale owned by Zillow, homes for rent and recently sold, as well as properties not currently on the market. This database is central to the value we provide to consumers and real estate, rental and mortgage professionals. It contains extensive information that users can search, through an easy-to-use interface, to identify, analyze and compare homes. Our database is relevant to a broad range of users, including buyers, sellers, renters, homeowners, real estate agents and other real estate professionals. It includes information such as:
  - *Property facts:* Zestimate and its corresponding value range, number of bedrooms, number of bathrooms, square footage, lot size, assessed tax value and property type such as single-family, condominium, apartment, multifamily, manufactured home or land.

- *Listing information:* price, price history and reductions, dollars per square foot, days on the market, listing type (such as for sale by agent, for sale by owner, pre-market inventory, which includes foreclosure, pre-foreclosure, Coming Soon and Make Me Move listings, new construction and rental homes), open houses, property photos and estimated monthly mortgage payment.
- *Purchase and sale data:* prior sales information and recent sales nearby.

We synthesize data from hundreds of automated feeds, representing information from tens of thousands of public and private sources. Applying extensive computer analytics to the data, we transform it into information that is accessible, understandable and useful.

We refer to the database as “living” because the information is continually updated by the combination of our proprietary algorithms, synthesis of third-party data from hundreds of sources, and through improvements by us and, importantly, by our community of users. User-generated content from owners, agents and others enriches our database with photos, videos, and additional property information. Individuals and businesses that use Zillow’s mobile applications and websites have updated information on more than 80 million homes in our database, creating exclusive home profiles not available anywhere else. Our inimitable database enables us to create content, products and services not available anywhere else, and attracts an active, vibrant community of users. As of December 31, 2018, we had published more than 4.4 million reviews, including more than 3.7 million reviews of local real estate agents and approximately 649,000 reviews of mortgage professionals submitted by our users on Zillow.

- *Zestimates and Rent Zestimates.* We have developed industry-leading automated home valuation models that use advanced statistical methods and complex, proprietary algorithms. We use these models to provide current home value estimates, or Zestimates, and current rental price estimates, or Rent Zestimates, on approximately 100 million U.S. homes. Based on our Zestimates, we produce Zillow Home Value Indexes at the neighborhood, zip code, city, metropolitan statistical area, county and national levels. Our Zillow Home Value Indexes have been cited by government entities such as the Federal Reserve Bank and the Congressional Oversight Panel, university studies and respected national publications. For historical comparisons, we provide up to 15 years of Zestimate history on each home and valuable information about property and real estate market trends. Our Zestimates, Rent Zestimates and Zillow Home Value Indexes allow consumers to evaluate homes and neighborhoods, and to easily evaluate historical trends, as they contemplate critical home-related decisions.
- *Mobile Leadership and Monetization.* We have developed and operate the most popular suite of mobile real estate applications across all major platforms. For example, on our flagship Zillow brand, during December 2018, nearly 880 million homes, or 328 homes per second, were viewed on a mobile device. More than two-thirds of our flagship brand Zillow’s usage occurs on a mobile device. We operate one of the most popular suites of mobile real estate applications with more than fifty applications across all major mobile platforms. We monetize our marketplace business on our mobile platform in the same way we do on our web platform.
- *Independent Market Positions and Consumer Focus.* Zillow Group has been built independent of any real estate industry group. We maintain an unwavering commitment to giving consumers free access to as much useful information as possible. We provide information, products and services, designed to empower consumers to make informed decisions about homes and the residential real estate market. We believe our independence enables us to create compelling products and services with broad consumer appeal.
- *Multiple Robust Home-Related Marketplaces.* We have created trusted and transparent marketplaces in real estate, rentals and mortgages where consumers can identify and connect with local professionals that are best suited to meet their needs. Our living database of homes provides a foundation on which we can build new consumer and professional marketplaces in other home-related categories.
- *Technology Solutions for Professionals.* We offer a suite of marketing and technology solutions to help real estate, rental and mortgage professionals grow their businesses and personal brands including our Premier Agent app that



allows real estate professionals to manage their business from wherever they are, dotloop that has digitized the real estate transaction, and Bridge Interactive which has streamlined listing data management.

- *Consumer-Oriented Mortgage Marketplace.* Unlike other sources of mortgage rate quotes, consumers can anonymously submit mortgage loan information requests and receive an unlimited number of personalized mortgage quotes directly from hundreds of consumer-rated lenders, including MLOA, through which we originate mortgages. Because we operate this marketplace as part of our real estate home shopping experience, we can efficiently attract motivated users to the marketplace and prioritize the consumer's experience. For the year ended December 31, 2018, there were approximately 25.4 million mortgage loan information requests submitted on Zillow Group platforms by consumers.
- *Personalized Experience.* We present homebuyers and sellers and real estate, rental and mortgage professionals with many opportunities to personalize their Zillow Group experience, leading to more informed home shopping and financing decisions. As immediacy is paramount in the home search experience, all Zillow Group mobile applications and websites empower users by allowing them to set the criteria that matters most to them, while we take on the action of alerting them when a home or rental that matches their criteria hits the market.
- *Proven Management Team.* We believe the broad experience and depth of our management team are distinct competitive advantages in the complex and evolving industry in which we compete. The Zillow Group management team has a mix of extensive experience building successful consumer internet companies and real estate and mortgages businesses. We believe the collective skills and experiences of our executives provide our management team with immense strategic insight and ability.

## Growth Strategies

Our growth strategies are:

- *Improve the Home-Related Transaction Experience for the Consumer.* Maintain our unwavering focus on empowering consumers with information and products and services that they love to use to make home-related decisions. Develop seamless end-to-end technology offerings that meet the ever-changing expectations of today's consumers in an on-demand economy, with a goal of earning consumers' preference for Zillow Group products and services across all stages of the home lifecycle.
- *Grow our Audience and Increase Engagement Across all Brands.* Expand our targeted marketing and advertising programs, public relations, social media initiatives and content distribution to efficiently increase consumer awareness across all brands in our portfolio. Increase footprint via international expansion, as well as into local markets with new products and services. Launch new brands, products and services that target specific demographics or geographies.
- *Continuously Provide Growth Opportunities for Residential Real Estate Agents and Brokers, Home Builders, Rental Property Managers, and Mortgage Lenders.* Provide real estate, rental and mortgage professionals participating in our marketplaces continuous opportunities to grow their respective businesses and increase transactions by creating opportunities for high-quality consumer-initiated connections. Support participating professionals by developing a broad variety of marketing software, technology solutions, productivity tools and other support services to help those professionals manage and grow their businesses and personal brands.
- *Deepen and Expand Our Marketplaces Across the Lifecycle of Homes.* Deepen and expand our platform beyond advertising services for real estate, rental and mortgage professionals through direct market participation, by purchasing homes from, selling homes to, and originating mortgages for consumers. In the future, develop other ancillary products and services to address friction in residential real estate transactions for consumers and industry professionals. Also, pursue commercial relationships and acquisitions to strengthen our market position, enhance our technology offerings and accelerate our growth.
- *Leverage our Data Advantage.* Enhance the information in our database of more than 110 million homes, and use it as the foundation for new analyses, insights and tools that inform strategic decisions. Our living database of homes

provides a foundation on which we can build new consumer and professional marketplaces in other home-related categories. Our unmatched audience size and traffic pattern data also provides us with a competitive advantage.

## **Real Estate Products and Services**

We provide advertising products and services for real estate, rental and mortgage professionals that enable them to create and promote useful content for consumers. Additionally, in 2018 we introduced new services to enable consumers to directly buy and sell homes through our Zillow Offers program and to help consumers finance real estate transactions through our acquisition of MLOA.

### *Premier Agent and Premier Broker Programs*

Our Premier Agent and Premier Broker programs offer a suite of marketing and business technology products and services to help real estate agents and brokers achieve their advertising goals, while growing and managing their businesses and brands. All Premier Agents and Premier Brokers receive access to a dashboard portal on our mobile application or website that provides individualized program performance analytics, our customer relationship management, or CRM, tool that captures detailed information about each contact made with a Premier Agent or Premier Broker through our mobile and web platforms and our account management tools.

We primarily offer our Premier Agent and Premier Broker advertising products on a cost per impression basis. Payment is received prior to the delivery of impressions. Impressions are delivered when a sold advertisement appears on pages viewed by users of our mobile applications and websites. We determine the cost per impression delivered in each zip code using an auction-based pricing method in consideration of the total amount spent by Premier Agents and Premier Brokers to purchase impressions in the zip code during the month. A Premier Agent's or Premier Broker's share of voice in a zip code is determined by their proportional monthly budgeted spend in that zip code as a percentage of the total monthly budgeted spend of all Premier Agents and Premier Brokers in that zip code. The cost per impression that we charge is dynamic - as demand for impressions in a zip code increases or decreases, the cost per impression in that zip code may be increased or decreased accordingly.

In April 2018, we began testing a new form of lead validation and distribution related to our auction-based pricing model whereby the share of voice purchased by Premier Agents and Premier Brokers represents both the share of impressions delivered as advertisements appearing on pages viewed by users of our mobile applications and websites, as well as the proportion of validated consumer connections a Premier Agent or Premier Broker receives. When consumers who are interested in connecting with a real estate professional do not select a specific Premier Agent or Premier Broker advertisement on one of Zillow Group's mobile applications or websites, the validated consumer leads will be distributed to Premier Agents and Premier Brokers in proportion to their share of voice. We believe distributing validated consumer connection leads on the basis of share of voice creates better experiences for consumers and further strengthens our partnerships with real estate professionals. We substantially completed the nationwide adoption of this new lead distribution model in the fourth quarter of 2018.

In October 2018, we began testing a new Flex Pricing model for Premier Broker and Premier Agent advertising services in limited markets. With the Flex Pricing model, Premier Brokers and Premier Agents are provided with validated leads at no upfront cost, and they pay a performance advertising fee only when a real estate transaction is closed with one of their leads.

### *Zillow Group Rentals*

Zillow Group continues to develop its rental marketplace across mobile applications and websites, that serve both consumers and rental professionals. Zillow Group Rentals is the largest rental network on the internet and includes listing distribution across Zillow, Trulia and HotPads, reaching millions of rental shoppers each month. Zillow Group Rentals advertisers gain access to the leading technology and marketing platform that connects rental properties with consumer contacts and, beginning in 2018, to tools to effectively convert contacts into tenants, including through a rental applications product.

*Mortgages*

We offer two mortgage advertising products – Connect (formerly known as “Long Form”) and Custom Quotes. In Zillow Group’s Connect platform, consumers answer a series of questions to find a local lender, and mortgage professionals receive contacts based on data such as location and customer reviews. In our Custom Quotes mortgage marketing platform, lending institutions display their mortgage rates directly to consumers who are shopping for refinance and purchase rates. In Custom Quotes, consumers request free, personalized quotes in response to their submission of limited anonymous data, such as specific loan amount, zip code, purchase price or estimated home value, and credit score. Consumers decide if and when to contact the mortgage professionals who provide quotes. For the year ended December 31, 2018, there were approximately 25.4 million mortgage loan information requests submitted on Zillow Group platforms by consumers through Connect and Custom Quotes. User-generated ratings and reviews of mortgage professionals are provided as a powerful tool to help consumers shop for their loans. Our Connect and Custom Quote services are operated by our wholly owned subsidiary, Zillow Group Marketplace, Inc. (formerly Zillow Group Mortgages, Inc.), a licensed mortgage broker, pursuant to a support services agreement.

In October 2018, we completed the acquisition of MLOA, a licensed mortgage lender. This acquisition is consistent with our strategy of moving further down funnel and closer to the real estate transaction to create better consumer experiences. Thus, beginning in the fourth quarter of 2018, Zillow’s suite of products now includes mortgage originations. This acquisition will allow Zillow to streamline and shorten the home-buying process for consumers who purchase homes through Zillow Offers.

*Zillow Group New Construction*

Zillow Group’s new construction marketing platform, Promoted Communities, allows home builders to showcase their available inventory to our millions of in-market home shoppers across the web. Promoted Communities continues to drive discoverability for home builders through dynamic listings of their available lots, plans, spec homes, and community details pages, while our Builder Boost products with Precision Targeting let home builders enhance their community’s presence on Zillow, Trulia and Facebook®. Zillow Group marketing partners also receive exclusive access to robust data and consumer insights to help them make informed marketing decisions.

*Zillow Offers*

In 2017, we began testing the Zillow Instant Offers marketplace, a way for homeowners to sell their homes quickly by providing them with offers from investors and a comparative market analysis from a local real estate agent as an estimate for what the home might fetch on the open market. Beginning in April 2018, Zillow discontinued the Instant Offers marketplace and launched the Zillow Offers service, which allows homeowners to either sell their home directly to Zillow or have Zillow connect them with a Premier Agent to assist in the sale of their home through a traditional listed transaction. If a homeowner accepts an offer from Zillow Offers, Zillow buys the house, makes certain repairs and updates, and then lists it for sale on the open market. The Zillow Offers service provides sellers with certainty, control, and convenience, allowing them to avoid the many complexities of a traditional residential sale process. As of December 31, 2018, Zillow Offers was buying and selling homes in 5 metropolitan areas across the U.S.

**Information Products and Services**

We provide consumers with information products and services to enable them to make intelligent decisions about homes.

*Zestimate and Rent Zestimate*

Our Zestimate and Rent Zestimate valuations are computed using complex, proprietary algorithms we have developed and refined through years of statistical analysis and technological development.

A Zestimate is our estimated current market value of a home. We generate Zestimates using a variety of information, including:

- *Physical attributes*: location, lot size, square footage, number of bedrooms and bathrooms and many other details.
- *Tax assessments*: property tax information, actual property taxes paid, exceptions to tax assessments and other information provided in the tax assessors' records.
- *Prior and current transactions*: actual sale prices over time of the home itself and comparable recent sales of nearby homes.
- *User data*: data provided directly by millions of users of our mobile applications and websites.

We use proprietary automated valuation models that apply advanced algorithms to analyze our data to identify relationships within a specific geographic area between home-related data and actual sales prices. We provide current home value estimates, or Zestimates, on approximately 100 million U.S. homes. Home characteristics, such as square footage, location or the number of bathrooms, are given different weights according to their influence on home sale prices in each specific geographic area over a specific period of time, resulting in a set of valuation rules, or models, that are applied to generate each home's Zestimate.

To improve the accuracy of our Zestimates, our algorithms automatically remove or reconcile data that would otherwise inappropriately skew the valuation rules. In addition, our algorithms will automatically generate a new set of valuation rules based on the constantly changing universe of data included in our database. This allows us to provide timely home value information on a massive scale, updated daily. In 2017, we announced Zillow Prize, a machine learning competition to improve Zestimate accuracy, with a grand prize of up to \$1 million to the person or team who submits the most improved Zestimate algorithm model, and in January 2019, we awarded the \$1 million prize to the winning team, which beat the Zillow benchmark model by approximately 13%.

We publicly disclose the accuracy of our Zestimates to further empower consumers in assessing a home's value. The accuracy may be impacted by a variety of factors, including the amount of data about homes we have for a particular geographic area.

A Rent Zestimate is our estimated current monthly rental price of a home, computed using automated valuation models, similar to our Zestimates, which we have designed to address the unique attributes of a rental home. We estimate rental prices on approximately 100 million homes, including apartments, single-family homes, condominiums and townhomes. Our Rent Zestimates are updated daily.



***Rich, Searchable Home-Related Data and Analysis***

We provide consumers and real estate professionals with a rich set of home-related information. Through our mobile applications and websites, users can access detailed information about homes, including:

<b>Value Information</b>	Zestimate	Regional foreclosure statistics
	Zestimate Forecasts	Prior sale prices
	Rent Zestimate	Historical Zestimate values
	For sale price	Historical Rent Zestimate values
	Estimated mortgage payment	Zillow Home Value Index
	Estimated down payment	Zillow Home Value Index Forecasts
	Rental price	Tax-assessed value
	Make Me Move price	Property taxes paid
	Easy links to county assessor records	Price per square foot
	Regional 12-month home value forecast	
<b>Home Details</b>	Bedrooms	Number of stories
	Bathrooms	Number of units in building
	Square footage	Finished basement
	Lot size	Cooling system
	Year built	Heating system
	Property type	Heat source
	County	Fireplace
	Parcel number	Exterior material
	Legal description	Parking type
	Construction quality	Garage size
<b>Neighborhood Information</b>	Location	
	School district	School ratings
	Elementary school	Crime data
	Middle school	Transit access
	High school	Boundaries
	Neighborhood and school reviews	Photos
<b>For Sale Listing Details</b>	Amenities	
	Price	Days on Zillow or Trulia
	Listing agent information	MLS number
	Listing brokerage information	Foreclosure stage and type
	Link to listing source	Home overview description
	Property type and property features	Neighborhood name and description
	Open house dates and times	Coming Soon on market date
	Virtual tour	Community information for newly constructed homes in developments
	Video walkthroughs	Building name and information
	Home photos	3D tours
<b>Rental Listing Details</b>	Price reductions	
	Building name and number of stories	Property manager
	Rent amount and lease terms	Parking availability
	Application and deposit fees	Utilities and amenities
	Historical rental listings	3D tours

Consumers and real estate professionals can update property information by, for example, adding home photos and personalized information regarding the neighborhood or school district, creating exclusive home profiles not available anywhere else.

Our map-based user interface enables our users to search, navigate and zoom to areas of interest and find and compare home information quickly and efficiently from a variety of different perspectives across homes, neighborhoods, cities, counties and other geographic regions. Our consumer search experience supports complex search queries and filters across our data set of homes, allowing consumers to customize their searches and gain actionable insights.

Our team of economists and statisticians generates unbiased local and national real estate data and analysis on 933 metropolitan areas and approximately 15,000 individual neighborhoods that we provide to consumers and real estate, rental and mortgage professionals at no cost. This gives our users access to local market trends and data, such as home price cuts, list to sale price ratio and foreclosure data that was historically not easily obtained, if available at all. Users can compare these metrics across neighborhoods and different time periods using our real-time charting and filtering.

### ***For Sale and Rental Listings***

We provide comprehensive for sale and rental listings through relationships with real estate brokerages, real estate listings aggregators, multiple listing services, apartment management companies, home builders, and other third parties. In addition, we provide consumers with access to exclusive home listings, such as our Make Me Move listings, which are a homeowner's posted price at which they would be willing to move. We also show listings that may not be available on other sources, including for sale by owner, pre-market inventory, including our Coming Soon listings, New Construction listings and rental listings as well as listings that are owned by Zillow through the Zillow Offers program and which are available for sale.

### ***Marketplace of Real Estate Agents***

We present consumers with ratings and contact information for the listing agent and local buyer's agents alongside home profiles and listings for homes to assist them in evaluating and selecting the real estate agent best suited for them. We enhance this offering by providing an online professional directory for consumers to search and contact real estate professionals that they might wish to engage. Our directory includes rich profiles of real estate professionals, including more than 3.7 million ratings and reviews provided by our users, allowing consumers to evaluate these agents based on a number of criteria, including neighborhood specialization and number of listings.

### ***Marketplace of Mortgage Professionals***

In our mortgages marketplace, consumers can answer a series of questions to find a local lender, and mortgage professionals receive contacts based on data such as location and customer reviews, or consumers can anonymously request free, personalized mortgage quotes from consumer-rated-and-reviewed mortgage professionals. Consumers can then choose to contact those mortgage professionals at their discretion. For the year ended December 31, 2018, there were approximately 25.4 million mortgage loan information requests submitted on Zillow Group platforms by consumers. More than half of consumers who submit a loan information request do so on a mobile device. As of December 31, 2018, we had published approximately 649,000 reviews of mortgage professionals submitted by our consumers.

### ***Mobile Access***

We operate one of the most popular suites of mobile real estate applications with more than fifty applications across all major mobile platforms. Our mobile real estate applications provide consumers and real estate, rental and mortgage professionals with location-based access to many of our products and services, including Zestimates, Rent Zestimates, for sale and rental listings and extensive home-related data. Through our mobile applications, for example, a consumer can learn about the home's for-sale price, Zestimate, number of bedrooms, square footage and past sales, as well as similar information about surrounding homes. The consumer can connect with a real estate professional through our mobile applications to get more

information or schedule a showing. For example, on our flagship Zillow brand, during December 2018, nearly 880 million homes were viewed on a mobile device, which equates to 328 homes per second.

## **Marketing**

We believe Zillow Group has considerable opportunity to increase brand awareness and grow traffic through product development, targeted advertising programs and strategic partnerships. As such, we opportunistically advertise to consumers and professionals in various online and offline channels that have tested well for us and pursue strategic partnerships that drive traffic and brand awareness for Zillow Group.

At Zillow Group, marketing begins with effective product development, which then becomes amplified by impactful brand advertising and marketing communications. We create immersive consumer products that people want to use frequently, talk about and share. More recently, we also began creating products that alleviate the stress of activities like selling or buying a home, such as Zillow Offers. The engaging nature of our products enables us to execute compelling advertising campaigns integrated with our robust and viral communications program, which together comprise the primary drivers of our brand awareness and traffic acquisition efforts.

The communications team for our flagship Zillow brand includes former journalists who have established Zillow Group as an authoritative source for information on a broad range of home and real estate-related subjects. A typical week includes commentary from our real estate experts across dozens of national print and broadcast media outlets, guest opinion pieces or blog posts by our chief economists, and wide-ranging national and local media coverage of Zillow Group products, including Zillow Offers, listings, data and consumer tips.

In September 2018, we released the third annual Zillow Group Report on Consumer Housing Trends, which highlights our latest consumer research. The report has garnered the attention of media outlets such as the *Wall Street Journal*, *New York Times*, *Fox Business*, *Associated Press* and *Money Magazine* and serves to establish Zillow Group as the authority on residential real estate consumers and their needs, aspirations and challenges.

We focus substantial public relations effort around the marketing of our Zillow Real Estate Market Reports, which are in-depth reports produced by our economics and analytics bureau for 909 U.S. markets. Data is released on a monthly and quarterly basis, and the data is widely used by government entities such as the Federal Reserve and Congressional Oversight Panel, as well as regularly featured in respected media outlets such as the *Wall Street Journal*, *New York Times*, *Bloomberg*, *Reuters* and across numerous national network and cable news shows including CNBC, CNN, Fox News and Bloomberg. We believe the considerable effort we have spent on public relations and social media has allowed us to build large and credible brands.

Our living database of homes creates significant opportunities for home-ownership lifecycle marketing. A typical person will at various times in life be a renter, buyer, homeowner, mortgage refinancee or seller, and this presents opportunities to communicate with consumers over many years before, during and after a transaction. We actively communicate with our users through email and social media channels.

## **Sales, Consumer Care and Customer Support**

Our sales teams are responsible for generating customers across our mobile applications and websites.

Our largest sales teams sell our Premier Agent and Premier Broker products to real estate agents, and are located in Seattle, Washington, Denver, Colorado, Irvine, California, and New York, New York. We also have sales teams in Seattle, Washington, Denver, Colorado, New York, New York, and Irvine, California that sell our rental products to rental professionals. In addition, we have sales teams in Seattle, Washington and Lincoln, Nebraska that support sales in our mortgage marketplaces. We also have sales teams in Seattle, Washington, Denver, Colorado, and San Francisco, California that sell our new construction marketing solutions. We attract customers through a combination of outbound calling and inbound customer requests generated from our websites and event marketing activities. We also maintain field sales teams in San Francisco,

California and New York, New York to specifically target larger advertising customers in the real estate and related content categories, such as real estate brokerages, home builders, lenders and home service providers, as well as advertisers in the telecommunications, automotive, insurance and other industries. Beginning in October 2018, as a result of our acquisition of MLOA, we maintain a team of loan origination officers in Overland Park, Kansas that support sales of mortgage originations.

We believe that consumer care and customer support are important to our success. Our consumer care and customer support teams are located in Seattle, Washington and Denver, Colorado. Our customer support team responds to commercial and technical issues from our advertisers, and our consumer care team responds to consumer issues from our user community. In addition, our Zillow Offers consumer care team works with consumers during the home selling process as the main point of contact for consumers, helping coordinate a transaction between the consumer and the local agent representing Zillow, or providing Premier Agents with listing appointment opportunities. The Zillow Offers consumer care teams are located in Seattle, Washington, Denver, Colorado, Atlanta, Georgia, and Dallas, Texas.

## **Technology and Infrastructure**

Zillow Group is a data- and technology-driven company. Our technical infrastructure, mobile applications and websites are built to provide consumers and real estate, rental and mortgage professionals with access to rich real estate data and powerful online tools to help them accomplish their home-related goals. Our success depends on our ability to innovate and enhance our products and services, adapt to changes in technology, and support new devices and operating systems.

Research and development costs are expensed as incurred and are recorded in technology and development expenses. For the years ended December 31, 2018, 2017 and 2016, expenses attributable to research and development for our business totaled \$298.1 million, \$193.0 million and \$170.1 million, respectively. We expect to continue making significant investments in research and development as we explore new ways to deliver greater value to our consumer users and advertiser customers. For information about our research and development costs, see Note 2 of the accompanying notes to our consolidated financial statements included within this annual report.

Many of our services are available through real-time web-based application programming interfaces that allow our information to be easily integrated into third-party websites. We provide HTML and JavaScript-based widgets to allow easy integration of Zillow Group information onto other websites, with little custom programming. Our technology platform is built using industry-leading third-party and internally developed software as well as open source technologies. This combination allows for rapid development and release of high-performance software in a cost-effective and scalable manner. Our mobile applications and websites are designed to have high availability, from the internet connectivity providers we choose, to the servers, databases and networking hardware that we deploy. We design our systems so that the failure of any individual component is not expected to affect the overall availability of our platform. We also leverage content delivery networks and use other third-party cloud computing services, including map-related and ad serving services, to ensure fast and local access to content. We employ a host of encryption, antivirus, firewall, monitoring, and patch-management technology to protect and maintain our systems.

To deliver web and mobile Zillow Group brand content while ensuring scalability and redundancy, we utilize both third-party web services for cloud computing and storage and shared data centers in Seattle, Washington and Santa Clara, California.

## **Intellectual Property**

We protect our intellectual property through a combination of trademarks, trade dress, domain names, copyrights, trade secrets and patents, as well as contractual provisions and restrictions on access to our proprietary technology.

Our trademarks registered in the United States and several other jurisdictions include, but are not limited to, “Zillow,” “Trulia,” “Zestimate,” “Premier Agent,” “Make Me Move,” “Mortech,” “Marksman,” “Hotpads,” “StreetEasy,” “dotloop,” “Find Your Way Home,” “Naked Apartments,” “New Home Feed,” the Z in a house logo, the Trulia marker logo, as well as logos that correspond with several of our other trademarks. We also have filed other trademark applications, including an

application for “Zillow Offers,” in the United States and certain other jurisdictions and will pursue additional trademark registrations to the extent we believe it will be beneficial and cost-effective.

We are the registered holder of a variety of domestic and international domain names that include, but are not limited to, “Zillowgroup.com,” “Zillow.com,” “Trulia.com,” “RealEstate.com,” “Mortech.com,” “HotPads.com,” “Streeteasy.com,” “DotLoop.com,” “Retsly.com,” “NakedApartments.com,” “BridgeInteractive.com,” “NewHomeFeed.com,” “Mortgagelendersofamerica.com,” and other similar variations. We view the strength of brand awareness and loyalty with respect to both our consumer- and business-facing brands as a key differentiator. As a result, our ability to protect these intellectual property assets is very important to our business.

We have 28 patents of varying lengths issued in the United States and internationally. These patents cover proprietary techniques that relate to determining a current value for a real estate property, performing summarization of geographic data points in response to zoom selection, the incorporation of individual aerial images and incorporating visual information into a master planar image, the collection, storage and display of home attribute values, providing for a multi-faceted search, and other proprietary techniques relevant to our products and services. Our Zestimate home valuation, for example, which we consider to be a significant competitive advantage with respect to consumer engagement, is currently protected by a patent. We have 47 patent applications pending in the United States and internationally, which seek to cover proprietary techniques relevant to our products and services. We intend to pursue additional patent protection to the extent we believe it will be beneficial and cost-effective.

In addition to the protection provided by our intellectual property rights, we enter into confidentiality and proprietary rights agreements with our employees, consultants, contractors and business partners. Our employees and contractors are also subject to invention assignment provisions. We further control the use of our proprietary technology and intellectual property through provisions in both our general and product-specific terms of use on our mobile applications and websites.

## **Competition**

We face competition to attract consumers to our mobile applications, websites, and services and to attract advertisers to purchase our advertising products and services.

### ***Competition for Consumers***

Our business model depends on our ability to attract consumers to our mobile applications, websites, and services and enhance their engagement with our products and services in a cost-effective manner. New entrants join the categories in which we operate at a rapid pace. Our competitors include companies that provide, or could develop, technology, products and services for real estate, rental, new construction and mortgage professionals and other residential real estate market participants, including operators of mobile applications and websites. We also compete with companies and individuals purchasing and selling homes in the metropolitan areas where we offer our Zillow Offers service and with companies originating mortgage loans in the states in which MLOA is a licensed lender. We compete for consumers primarily on the basis of the quality of the consumer experience, the utility of the data and services we provide, the breadth, depth and accuracy of information, brand awareness and reputation, and the value we offer to home buyers and sellers. We believe we compete favorably on these factors.

### ***Competition for Advertisers***

We face intense competition from traditional and online or mobile media sources to attract advertisers. Online and on mobile, we compete with website operators dedicated to providing real estate, rental, new construction, and mortgage information and services to real estate professionals and consumers, local brokerage sites and major internet portals, general search engines, e-commerce, and social media sites, as well as other technology and media companies. We also compete for a share of advertisers’ overall marketing budgets with traditional media such as television, magazines, newspapers and home/apartment guide publications, particularly with respect to advertising dollars spent at the local level by real estate professionals to advertise their qualifications and listings. We compete for advertising revenue based on perceived return on investment and perceived transaction readiness and overall quality of consumer leads, the effectiveness and relevance of our



advertising products, pricing structure and our ability to effectively deliver types of ads to targeted demographics. We believe we compete favorably on these factors.

## **Government Regulation**

We operate in an increasingly complex legal and regulatory environment. Our business and the products and services that we offer are affected by a continually expanding and evolving range of local, state, federal, and international laws and regulations.

Our IMT segment, which includes the provision of advertising services, marketing software, and technology solutions to businesses and professionals primarily associated with the residential real estate, rental and mortgages industries, is subject to a variety of laws and regulations relating to the collection, use, and disclosure of data collected from our users, including those promulgated and enforced by the U.S. Federal Trade Commission and certain states, such as the California Consumer Privacy Act of 2018, which we expect to come into effect on January 1, 2020. Additionally, laws, regulations, and standards covering marketing and advertising activities conducted by telephone, email, mobile devices, and the internet, may be applicable to our business, such as the Telephone Consumer Protection Act, the Telemarketing Sales Rule, the CAN-SPAM Act, and similar state consumer protection laws.

By providing a medium through which users can post content and communicate with one another, we may also be subject to laws governing intellectual property ownership, obscenity, libel, and privacy, among other issues. In addition, the real estate agents, mortgage professionals, banks, property managers, rental agents and certain of our other customers and advertisers are subject to various state and federal laws and regulations, including, but not limited to those relating to real estate, rentals and mortgages, which may impact their use of our mobile applications and websites. We endeavor to ensure that any content created by Zillow Group is consistent with such laws and regulations by obtaining assurances of compliance from our advertisers and consumers for their activities through, and the content they provide on, our mobile applications and websites.

Certain of our mortgage marketing products are operated by our wholly owned subsidiary, Zillow Group Marketplace, Inc. (formerly Zillow Group Mortgages, Inc.), a licensed mortgage broker, and in October 2018 we completed the acquisition of MLOA, a licensed mortgage lender, through which we originate residential mortgages. Mortgage products are regulated at the state level by licensing authorities and administrative agencies, with additional oversight from the Bureau of Consumer Financial Protection (“BCFP”) and other federal agencies. Zillow Group Marketplace, Inc. and MLOA are subject to stringent state and federal laws and regulations and to the scrutiny of state and federal government agencies as a licensed mortgage broker and licensed mortgage lender, respectively, including numerous consumer protection laws.

As a buyer and seller of residential real estate through our Zillow Offers business, we may be subject to additional local, state and federal laws and regulations governing such transactions, including those administered by the BCFP, the Department of Housing and Urban Development, and the states and municipalities in which we transact.

The real estate, mortgages, and rentals industries in which we operate and provide services are subject to significant state, local and federal laws and regulation, and certain of our activities may be deemed to be covered by these industry-specific laws and regulations. Since the laws and regulations governing real estate, rentals and mortgages are constantly evolving and striving to keep pace with innovations in technology and media, it is possible that we may have to materially alter the way we conduct some parts of our business activities or be prohibited from conducting such activities altogether at some point in the future. See “Risk Factors” for a discussion of our regulatory risks.

## **Employees**

As of December 31, 2018, we had 4,336 full-time employees.

## Where You Can Find More Information

Our filings with the Securities and Exchange Commission, or SEC, including our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K, and amendments to those reports, are available on the “Investors” section of our website at [www.zillowgroup.com](http://www.zillowgroup.com), free of charge, as soon as reasonably practicable after the electronic filing of these reports with the SEC. The information contained on our website is not a part of this Annual Report on Form 10-K or any other document we file with the SEC.

Investors and others should note that Zillow Group announces material financial information to its investors using its press releases, SEC filings and public conference calls and webcasts. Zillow Group intends to also use the following channels as a means of disclosing information about Zillow Group, its services and other matters and for complying with its disclosure obligations under Regulation FD:

- Zillow Group Investor Relations Webpage (<http://investors.zillowgroup.com>)
- Zillow Group Investor Relations Blog (<http://www.zillowgroup.com/ir-blog>)
- Zillow Group Twitter Account (<https://twitter.com/zillowgroup>)

The information Zillow Group posts through these channels may be deemed material. Accordingly, investors should monitor these channels, in addition to following Zillow Group’s press releases, SEC filings and public conference calls and webcasts. This list may be updated from time to time. The information we post through these channels is not a part of this Annual Report on Form 10-K or any other document we file with the SEC, and the inclusion of our website addresses and Twitter account are as inactive textual references only.

## Item 1A. Risk Factors.

*Our business is subject to numerous risks. You should carefully consider the following risk factors, as any of these risks could harm our business, results of operations, and future financial performance. Recovery pursuant to our insurance policies may not be available due to policy definitions of covered losses or other factors, and available insurance may be insufficient to compensate for damages, expenses, fines, penalties, and other losses we may incur as a result of these and other risks. In addition, risks and uncertainties not currently known to us or that we currently deem to be immaterial may materially adversely affect our business, financial condition and operating results. If any of these risks occur, the trading price of our common and capital stock could decline, and you could lose all or part of your investment.*

### Risks Related to Our Business and Industry

***If Real Estate, Rental and Mortgage Professionals, Home Builders or Other Advertisers Reduce or End Their Advertising Spending With Us or if We Are Unable to Effectively Manage Advertising Inventory or Pricing, Our Business Would Be Harmed.***

Our current financial model depends in due part on revenue generated primarily through sales of advertising products and services to real estate agents and brokerages, rental professionals, mortgage professionals, home builders, and other advertisers in categories relevant to real estate. Our ability to attract and retain advertisers, and ultimately to generate advertising revenue, depends on a number of factors, including how successfully we can:

- increase the number of consumers who use our products and services, provide them with tools to promote engagement between real estate market participants, and enhance their user experience so we can retain them;
- offer an attractive return on investment to our advertisers for their advertising spending with us;
- continue to develop our advertising products and services to increase adoption by and engagement with advertising customers;
- keep pace with and anticipate changes in technology to provide industry-leading products and services to advertisers and consumers; and
- compete effectively for advertising dollars with other online media companies.

Premier Agent revenue, derived from our flagship Premier Agent program and Premier Broker program, accounted for 67% of total revenue for the year ended December 31, 2018. This level of revenue concentration suggests that even modest decreases in individual agent advertiser spending across the advertiser population, caused by actual or perceived decreases to return on investment, preference for a competitive service, or other factors, could have a significant negative impact on our results of operations. We do not have long-term contracts with most of our advertisers. Our advertisers could choose to modify or discontinue their relationships with us with little or no advance notice. For example, our auction-based account interface for Premier Agent advertisers allows agent advertisers to independently control the duration of their advertising commitments. We may not succeed in retaining existing advertisers' spending or capturing a greater share of such spending if we are unable to convince advertisers of the effectiveness or superiority of our products as compared to alternatives, including traditional offline advertising media such as television and newspapers. In addition, we continually evaluate and utilize various pricing and value delivery strategies in order to better align our revenue opportunities with the growth in usage of our mobile and web platforms. In 2016, for example, we implemented a new auction-based pricing method for our Premier Agent products, and in the second quarter of 2018, we began testing a new form of lead validation and distribution related to our auction-based pricing model whereby the share of voice purchased by Premier Agents and Premier Brokers represents both the share of impressions delivered as advertisements appearing on pages viewed by users of our mobile applications and websites, as well as the proportion of validated consumer connections a Premier Agent or Premier Broker receives. These changes combined with other market factors led to an increase in cost-per-lead and a decrease in leads delivered to certain advertisers in the third quarter of 2018, which resulted in higher than expected advertiser churn. Future changes to our pricing or lead delivery methodologies for advertising services or product offerings may cause advertisers to reduce or end their advertising with us or negatively impact our ability to manage revenue opportunities. If advertisers reduce or end their advertising spending with us, or if we are unable to effectively manage inventory and pricing, our advertising revenue and business, results of operations and financial condition would be harmed.

***If We Do Not Innovate or Provide High-Quality Products and Services on Mobile and the Web That Are Attractive to Our Users and to Our Advertisers, Our Business Could Be Harmed.***

Our success depends on our continued innovation to provide new, and improve upon existing, products and services that make our mobile applications, websites and other products and services useful for consumers and real estate, rental and mortgage professionals, and attractive to our advertisers. As a result, we must continually invest significant resources in research and development to improve the attractiveness and comprehensiveness of our products and services, adapt to changes in technology, and support new devices and operating systems. If we are unable to provide products and services that users, including real estate professionals, want to use, on the devices they prefer, then users may become dissatisfied and use competitors' mobile applications, websites, products and services. If consumers begin to access real estate information and services through other media and we fail to innovate, our business may be negatively impacted. If we are unable to continue offering high-quality, innovative products and services, we may be unable to attract additional users and advertisers or retain our current users and advertisers, which could harm our business, results of operations and financial condition.

***We Face Competition for Consumers in the Real Estate Category, Which Could Impair Our Ability to Attract Users of Our Mobile Applications, Websites and Other Products and Services, Which Would Harm Our Business, Results of Operations and Financial Condition.***

Our business model depends on our ability to continue to attract consumers to our mobile applications, websites and other services and enhance their engagement with our products and services in a cost-effective manner. New entrants continue to join the category at a rapid pace. Our existing and potential competitors include companies that operate, or could develop, national and local real estate, rental, new construction and mortgage mobile applications and websites. Such competitors range from companies offering traditional offline advertising media, like newspapers, to new mobile- or web-only technology companies. These companies could devote greater financial, technical and other resources than we have available to sales, advertising, or research and development, have a more accelerated time frame for deployment, or leverage their existing user bases and proprietary technologies to provide products and services that consumers might view as superior to our offerings. Any of our future or existing competitors may introduce different solutions that attract consumers or provide solutions similar to our own but with better branding or marketing resources. If we are not able to continue to attract consumers to our mobile applications, websites and other services, our business, results of operations and financial condition would be harmed.

***We May Not Be Able to Compete Successfully Against Our Existing or Future Competitors in Attracting Advertisers, Which Could Harm Our Business, Results of Operations and Financial Condition.***

We face intense competition from traditional and online or mobile media sources to attract advertisers. Online and on mobile, we compete against websites dedicated to providing real estate, rental, new construction, and mortgage information and services to real estate professionals and consumers, major internet portals, general search engines, e-commerce, and social media sites, as well as other technology and media companies. We also compete for a share of advertisers' overall marketing budgets with traditional media such as television, magazines, newspapers and home/apartment guide publications, particularly with respect to advertising dollars spent at the local level by real estate professionals to advertise their qualifications and listings. Large companies with significant brand recognition have large numbers of direct sales personnel and substantial proprietary advertising inventory and web traffic, which may provide a competitive advantage. To compete successfully for advertisers against future and existing competitors, we must continue to invest resources in developing our advertising platform and proving the effectiveness and relevance of our advertising products and services. Pressure from competitors seeking to acquire a greater share of our advertisers' overall marketing budget could adversely affect our pricing and margins, lower our revenue, and increase our research and development and marketing expenses. If we are unable to compete successfully against our existing or future competitors, our business, results of operations or financial condition would be harmed.

***We Compete in a Dynamic Industry, and We May Invest Significant Resources to Pursue Strategies and Develop New Products and Services That Do Not Prove Effective.***

The industry for residential real estate technology, information marketplaces, services, and advertising is dynamic, and the expectations and behaviors of consumers and professionals shift constantly and rapidly. We continue to learn a great deal about the behaviors and objectives of residential real estate market participants as the industry evolves and are investing significant resources to develop, test, and launch products and services to address the needs of the market and improve the homebuying, selling, financing, building, and renting experience. Changes or additions to our products and services may not attract or engage our users, and may reduce confidence in our products and services, negatively impact the quality of our brands, upset other industry participants, expose us to increased market or legal risks, subject us to new laws and regulations, or otherwise harm our business. For example, our Zillow Offers service, which allows home sellers to request an offer from Zillow to purchase their home, may not engage home sellers as we think it will. Further, if we do not realize the benefits we expect from strategic relationships we enter into, including for example, the generation of additional advertising revenue opportunities, our business could be harmed. We may not successfully anticipate or keep pace with industry changes, and we may invest considerable financial, personnel, and other resources to pursue strategies that do not, ultimately, prove effective such that our results of operations and financial condition may be harmed.

***Zillow Offers Could Fail to Achieve Expected Results and Cause Harm to Our Financial Results, Operations, and Reputation.***

Beginning in April 2018, Zillow purchases homes, makes certain repairs and updates, and attempts to sell the homes back into the market through its Zillow Offers service (the "Homes business"). This initiative may expose us to a variety of financial, legal, and reputational risks. The success of the Homes business depends in part on our ability to efficiently acquire, renovate, and sell properties. In determining whether to purchase a property, we may make assumptions, including the estimated time from purchase to sale, update costs, market conditions and potential resale proceeds, closing costs, and holding costs. These assumptions may be inaccurate. Our estimates of what homes are worth may not be accurate, and we may pay more for homes than the price at which we are able to resell them. In addition, we may not timely discover latent home construction or environmental hazards or other issues which may decrease the value of properties we own. As a result, we may not be able to resell them for the price we anticipated or at all. Further, homes we purchase may suffer decreases in value due to natural disasters, catastrophic events, or other forces outside of our control. The homes we own may not be insured against all damages and losses.

We may compete with other purchasers for the acquisition of properties, and some of those competitors may be willing to pay more for such homes than we are or have greater financial or other resources than we do. Competition for the purchase of homes may result in our purchase of fewer properties, higher purchase prices, and lower margins - or losses - realized on the sale of our homes.

The supply of and demand for homes, and the amounts prospective homebuyers are willing to pay for properties, are impacted by the strength of the overall economy, employment levels, availability of credit, tax or other governmental incentives that encourage homeownership, and regulation of mortgage interest rates, among other factors. Changes to these factors may negatively impact our ability to purchase a sufficient number of properties to realize benefits of scale and sell properties at the amounts we anticipated, if at all.

The actual or perceived quality of the homes we sell may be poor due to factors both within and beyond our control, such as our decision to make certain upgrades but not others and latent defects in properties of which we are not aware. Properties may experience unsafe conditions while we own them or soon after we resell them, which may cause harm to person or property. We may be subject to new legal, regulatory, local ordinance, and other requirements, as well as disputes with consumers, service providers, and others arising from our purchase, renovation, or resale of properties. These and other factors may reduce consumer confidence in our services and negatively impact our business reputation.

We use local and national third-party vendors and service providers to make upgrades to and perform maintenance on homes, and we can provide no assurances that we will have uninterrupted or unlimited access to their services or that we will be able to effectively control the timing and costs of their projects. If we do not select and maintain appropriate third parties to provide these services, our reputation and financial results may suffer.

We attempt to ensure that our properties are adequately insured to cover casualty losses while we hold them. However, there are certain losses, including losses from floods, fires, earthquakes, wind, pollution, certain environmental hazards, security breaches, and others for which we may not be insured because it may not be deemed economically feasible or prudent to do so, among other reasons. Any losses resulting from lack of insurance coverage could cause our financial results to suffer.

We have limited experience purchasing, upgrading, and selling homes, and our forecasts of financial results for this new business segment may vary significantly from our actual results. The accounting treatment, operational demands, and other aspects of the Homes business are very different from our Internet, Media, and Technology (“IMT”) business and may impact our overall results in ways that are difficult to predict.

***Our Entry into the Mortgage Lending Business Could Fail to Achieve Expected Results and Cause Harm to Our Financial Results, Operations, and Reputation.***

In October 2018, we completed the acquisition of Mortgage Lenders of America, L.L.C. (“MLOA”), a licensed mortgage lender. This acquisition and our operation of a mortgage lending business may expose us to a variety of financial, legal, and reputational risks. MLOA has historically funded its lending operations using its warehouse credit facilities, intending to sell all loans and corresponding servicing rights to third-party financial institutions after a holding period. Sales of loans to third parties are subject to origination quality standards, investor guidelines, and applicable laws, and these institutions still retain contractual and other rights to reject the loans after they are sold. If MLOA is unable to sell its loans or is required to repurchase the loans from third parties due to representation and warranty or other claims, MLOA may be required to hold the loans for investment or sell them at a discount.

Additionally, for residential mortgage loans that we originate, MLOA is required to comply with complex mortgage regulations, laws, and third-party guidelines. Borrowers may allege that the origination of the loans did not comply with applicable laws or regulations in one or more respects and assert such violation as an affirmative defense to payment or in an action seeking statutory and other damages in connection with such violation. If we are not successful in demonstrating that the loans in dispute were originated in accordance with applicable statutes and regulations, we could become subject to monetary damages and other civil penalties. Similarly, the third-party financial institutions to whom we sell the loans may claim that the origination of the loans did not comply with the terms of our agreements or applicable guidelines, laws or regulations, and may require MLOA to repurchase loans upon discovery of a breach. In addition, the government sponsored entities that insure some of the loans that MLOA originates may allege that the loans do not comply with the terms of their programs or applicable guidelines, laws or regulations, and may require MLOA to indemnify them for losses incurred in connection with such loans.



Historically, MLOA has offered a limited number of mortgage products to consumers under conventional and government guaranteed loan programs. If these programs do not meet the financing needs of our consumers, and we do not adapt to market changes and consumer preferences, consumers may opt to obtain financing from other lenders who offer different or more competitive loan products, including second mortgages, reverse mortgages, home equity lines of credit, or higher priced mortgage loans. Similarly, if any of the government sponsored entities amend the terms of an existing loan program, cease offering the program, limit our ability to use the program in connection with our Zillow Offers business, or revoke the authority of MLOA to offer such programs, we may have to make changes to or discontinue the mortgage products that we offer, which may negatively affect our business.

We may use derivatives and other instruments to hedge our mortgage lending interest rate risk. We may not hedge all of our risk, and we may not be successful in hedging any of the risk. Hedging is a complex process, requiring sophisticated models and constant monitoring. We may hedge our interest rate risk by utilizing forward loan sale commitments which may not adequately mitigate the impact of changes in interest rates. We could incur losses from our hedging activities. There may be periods where we elect not to use derivatives and other instruments to hedge mortgage lending interest rate risk.

Our recent entry into the mortgage lending business may also cause a negative reaction within the mortgage industry, including among some of our mortgage advertisers, which could harm our reputation, results of operations and financial condition.

***We Depend on the Real Estate Industry, and Changes to That Industry, Including to Supply and Demand in the Real Estate Market or Mortgage Lending Regulation, Could Reduce the Demand for, or Restrict Our Ability to Provide, Our Products and Services.***

Our financial results significantly depend on real estate market participants using our products and services. Real estate shopping patterns depend on the overall health of the real estate market. Changes to the regulation of the real estate industry, including mortgage lending, may negatively impact the prevalence of home ownership, the amount home buyers are willing and able to spend, and the ability of market participants to close transactions.

Changes to the real estate industry, including to supply and demand in the real estate market, regulation of rental properties, or mortgage interest rates, could reduce demand for our services. In addition, real estate, rental, and mortgage professionals are subject to comprehensive, and rapidly evolving, federal, state, and local laws and regulations which may cause them to significantly alter, decrease, or terminate their purchase of our products and services. Seasonality, micro- and macroeconomic factors, government regulation, tax laws, and other factors may decrease consumer usage as well as sales to our advertisers and other customers, which could harm our results of operations and financial condition.

Certain of our mortgage marketing products are operated by our wholly owned subsidiary, Zillow Group Marketplace, Inc. (formerly Zillow Group Mortgages, Inc.), a licensed mortgage broker, and in October 2018 we completed the acquisition of MLOA, a licensed mortgage lender, through which we originate residential mortgages. Zillow Group Marketplace, Inc. and MLOA are subject to stringent state and federal laws and regulations and to the scrutiny of state and federal government agencies as a licensed mortgage broker and licensed mortgage lender, respectively. Further, due to the geographic scope of our operations and the nature of the services we provide, we maintain real estate brokerage, mortgage broker, and mortgage lender licenses in certain states in which we operate, including in connection with Zillow Offers. In connection with such licenses, we are required to designate individual licensed brokers of record, qualified individuals and control persons. We cannot assure you that we, or our licensed personnel, are and will remain at all times, in full compliance with state and federal real estate and mortgage licensing laws and regulations and we may be subject to fines or penalties in the event of any non-compliance. If in the future a state agency were to determine that we are required to obtain additional licenses in that state in order to operate our business, or if we lose or do not renew an existing license or are otherwise found to be in violation of a law or regulation, we may be subject to fines or legal penalties, lawsuits, enforcement actions, or our business operations in that state may be suspended or prohibited. Compliance with these laws and regulations is complicated and costly and may inhibit our ability to innovate or grow. Any failure to comply with applicable laws and regulations may limit our ability to expand into new markets, offer new products or continue to operate in one or more of our current markets.

***Natural Disasters and Catastrophic Events May Disrupt Real Estate Markets and our Business.***

The occurrence of a significant natural disaster or other catastrophic event, such as earthquake, hurricane, fire, flood, terrorist attack or other similar event, may damage or disrupt our operations, local and regional real estate markets or economies, and negatively impact our business, results of operations and financial condition. Our largest offices are located in Seattle, Washington, Denver, Colorado, and San Francisco, California, and our mortgage origination business is located in Overland Park, Kansas; an earthquake or other natural disaster in any of these cities could disrupt our engineering, sales and/or mortgage origination teams and equipment critical to the operation of our business. Similarly, a significant natural disaster or other catastrophic event in any major U.S. city could negatively impact a large number of our advertisers and users, and cause a decrease in our revenue or traffic. For example, in connection with the hurricanes and wildfires that occurred during the second half of 2017, we worked closely with our Premier Agents and other advertisers in affected areas to help manage their advertising budgets, and we provided relief initiatives, which included billing credits and other forms of advertiser assistance. We also experienced a temporary decline in traffic to our mobile applications and websites from consumers in impacted areas during September 2017. Though our relief initiatives and the temporary decline in traffic did not have a material impact on our results of operations and financial condition for 2017, our results of operations and financial condition may be negatively affected by natural disasters in the future. In addition, through Zillow Offers, Zillow purchases, updates and sells homes in certain metropolitan areas, and through MLOA, we originate loans in over 40 states. The occurrence of a natural disaster or other catastrophic event in any of these localities could have a significant negative impact on those real estate markets and the success of our Homes and mortgage origination businesses in the affected regions.

***We May Not Be Able to Maintain or Establish Relationships With Real Estate Brokerages, Real Estate Listing Aggregators, Multiple Listing Services, Property Management Companies, Home Builders and Other Third-Party Listing Providers, Which Could Limit the Information We Are Able to Provide to Our Users.***

Our ability to attract users to our mobile applications, websites and other tools depends to some degree on providing timely access to comprehensive and accurate for-sale, new construction and rental listings. To provide these listings, we maintain relationships with real estate brokerages, real estate listing aggregators, multiple listing services (“MLSs”), property management companies, home builders, other third-party listing providers, and homeowners and their real estate agents to include listing data in our services. Many of our agreements with real estate listing providers are short-term agreements that may be terminated with limited notice. Many of our competitors and other real estate websites have similar access to MLSs and listing data, and may be able to source real estate information faster or more efficiently than we can. Another industry participant or group could create a new listings data service, which could impact the relative quality or quantity of information of our listing providers. The loss of existing relationships with MLSs and other listing providers, whether due to termination of agreements or otherwise, changes to our rights to use or timely access listing data, or an inability to continue to add new listing providers or changes to the way real estate information is shared, may negatively impact our listing data quality. This could reduce user confidence in the sale and rental data we provide and make us less popular with consumers, which could harm our business, results of operations and financial condition.

***We May Not Be Able to Maintain or Establish Relationships With Data Providers, Which Could Limit the Information We Are Able to Provide to Our Users and Impair Our Ability to Attract or Retain Users.***

We obtain real estate data, such as transaction history, property descriptions, tax-assessed value and property taxes paid, under licenses from third-party data providers. We use this data to enable the development, maintenance and improvement of our marketplace and information services, including Zestimates, Rent Zestimates and our living database of homes. We have invested significant time and resources to develop proprietary algorithms, valuation models, software and practices to use and improve on this specific data. We may be unable to renew our licenses with these data providers, enter into new data license agreements, or we may be able to do so only on terms that are less favorable to us, which could harm our ability to continue to develop, maintain and improve these information services and could harm our business, results of operations and financial condition.

***If Our Data Integrity Suffers Real or Perceived Harm, Consumers and Advertisers May Decrease Use or Cease Using Our Products and Services, and We May Be Subject to Legal Liability.***

Because homes represent significant investments, and many consumer decisions regarding homes are data-driven, our ability to attract and retain users and advertisers to our information products and services is dependent upon our ability to publish, and reputation for publishing, accurate and complete residential real estate information through our mobile applications and websites. As discussed above, a significant amount of the data we publish on our mobile applications and websites are licensed from third parties, and we have limited ability to control the quality of the information we receive from them. We also publish a significant amount of user-generated content, and our tools and processes designed to ensure the accuracy, quality, and legality of such content may not always be effective. Data we generate independently are subject to error, unauthorized modification by way of third-party viruses, and other factors. As the volume of data we publish increases, and potential threats to data quality become more complex, the risk of harm to our data integrity also increases. If our data integrity suffers real or perceived harm, we may be subject to legal liability, and consumers and advertisers may decrease their use or cease using our products and services, which would harm our results of operations and financial condition.

***Our Dedication to Making Decisions Based Primarily on the Best Interests of Consumers May Cause Us to Forgo Short-Term Gains.***

Our guiding principle is to build our business by making decisions based primarily on the best interests of consumers, which we believe has been essential to our success in increasing our user growth rate and engagement and has served the long-term interests of our company and our shareholders. In the past, we have forgone, and we will in the future forgo, certain expansion or short-term revenue opportunities that we do not believe are in the best interests of consumers, even if such decisions negatively impact our short-term results of operations. In addition, our philosophy of putting consumers first may negatively impact our relationships with our existing or prospective advertisers. This could result in a loss of advertisers, which could harm our revenue and results of operations. For example, we believe that some real estate agents have chosen not to purchase our Premier Agent advertising product because we display a Zestimate on their for-sale listings. We believe, however, that it is valuable to consumers to have access to a valuation starting point on all homes and so we display a Zestimate on every home in the Zillow database for which we have sufficient data to produce the Zestimate. Our consumer focus may also negatively impact our relationships with real estate brokerages, MLSs, and other industry participants on whom we rely for listings information. Our Zillow Offers product and our acquisition of MLOA, for example, may be perceived as impinging upon the business models of real estate agents, brokerages and lenders, which may cause them to terminate their listings agreements with us or, with respect to brokerages and lenders, cease advertising with us. Such risks could have a materially negative impact on our results of operations. Our principle of making decisions based primarily on the best interests of consumers may not result in the long-term benefits that we expect, in which case our user traffic and engagement, business and results of operations could be harmed.

***We Are Subject to Disputes Regarding the Accuracy or Display of Our Zestimates and Rent Zestimates.***

We provide our users with Zestimate and Rent Zestimate home and rental valuations. Zestimates are our estimated current market values of a home based on our proprietary automated valuation models that apply advanced algorithms to analyze our data; they are not appraisals. A Rent Zestimate is our estimated current monthly rental price of a home, using similar automated valuation models that we have designed to address the unique attributes of rental homes. We are, from time to time, involved in disputes with property owners and others who disagree with the accuracy or display of a Zestimate or Rent Zestimate, and such disputes may result in costly litigation in the future. Further, revisions to our automated valuation models, or the algorithms that underlie them, poor data quality, or other factors may cause certain Zestimates or Rent Zestimates to vary from expectations for those Zestimates or Rent Zestimates. Any such dispute or variation in Zestimates or Rent Zestimates could result in distraction from our business or potentially harm our reputation and financial condition.

***We Rely on Internet Search Engines and Mobile Application Marketplaces to Connect with Consumers.***

We rely on organic traffic generated from search engines like Google to attract users to our websites. This organic traffic is dependent in part upon the way in which links to and information from our websites are featured on search engine result pages. The ranking and other display features of links to and information from our websites is impacted by a variety of factors,

many of which are not within our control, such as a change to the search engine ranking algorithm. We devote significant time and resources to digital marketing initiatives, such as search engine optimization, to improve our search result rankings and increase visits to our sites. These marketing efforts may prove unsuccessful due to a variety of factors, including increased costs to use online advertising platforms, ineffective campaigns and increased competition. We also rely on mobile application marketplaces like Apple's App Store and Google Play to connect users with our mobile applications. These marketplaces may change in a way that negatively affects the prominence of or ease with which users can access our mobile applications. Such changes to Internet search engines or mobile application marketplaces may adversely impact our ability to connect with consumers, which could have a material negative effect on our results of operations and financial condition.

***We May Be Unable to Increase Awareness of the Zillow Group Brands Cost-effectively, Which Could Harm Our Business.***

We believe the Zillow Group brands, including Zillow and Trulia, are key assets of our company. Awareness and perceived quality and differentiation of the Zillow Group brands are important aspects of our efforts to attract and expand the number of consumers who use our mobile applications and websites. Should the competition and costs for awareness and brand preference increase among providers of mobile or online real estate information, we may not be able to successfully maintain or enhance the strength of our brand. We expect to continue to invest in our paid advertising to increase brand awareness and grow traffic. Paid advertising may not continue to be successful or cost-effective. If we are unable to maintain or enhance user and advertiser awareness of our brands cost-effectively, or if we are unable to recover our additional marketing and advertising costs through increased usage of our products and services, our business, results of operations and financial condition could be harmed.

***If We Fail to Manage Our Growth and Multi-Brand Portfolio Effectively, Our Reputation, Results of Operations and Business Could Be Harmed.***

We have experienced rapid and significant growth in our headcount and related operations, including as a result of the February 2015 Trulia acquisition and other acquisitions. We have also acquired or launched several new business-to-consumer and business-to-business brands in recent years, including the October 2018 acquisition of MLOA, a consumer-facing mortgage lending business, the April 2018 launch of Zillow Offers, the 2017 acquisition of New Home Feed, a listing management technology company, and the launch of OutEast.com, a consumer-facing website for real estate in the Hamptons. This growth adds complexity to business operations, including internal controls and compliance, and places substantial demand on management and our operational infrastructure. As we continue to grow, we must effectively integrate, develop and motivate a large number of new employees, while maintaining the beneficial aspects of our company culture, and successfully manage a diverse portfolio of brands. If we do not manage the growth of our business and operations effectively, the quality of our services and efficiency of our operations could suffer, which could harm our brand, results of operations and overall business.

***We Rely on the Performance of Highly Skilled Personnel, and if We Are Unable to Attract, Retain and Motivate Well-Qualified Employees, Our Business Could Be Harmed.***

We believe our success has depended, and continues to depend, on the efforts and talents of our management and our highly skilled team of employees, including our software engineers, statisticians, marketing professionals and advertising sales staff. Our future success depends on our continuing ability to attract, develop, motivate and retain highly qualified and skilled employees. The loss of any of our senior management or key employees could materially adversely affect our ability to build on the efforts they have undertaken and to execute our business plan, and we may not be able to find adequate replacements. The market for highly skilled personnel is very competitive. We cannot ensure that we will be able to retain the services of any members of our senior management or other key employees. If we do not succeed in attracting well-qualified employees or retaining and motivating existing employees in a cost-effective manner, our business could be harmed.

***We May Make Acquisitions and Investments, Which Could Result in Operating Difficulties, Dilution and Other Harmful Consequences.***

We continue to evaluate a wide array of potential strategic opportunities, including acquisitions and investments. For example, we acquired MLOA in October 2018, and acquired Hamptons Real Estate Online, or HREO, and New Home Feed, and purchased an equity interest in a privately held corporation, in the year ended December 31, 2017. Any transactions that we enter into could be material to our financial condition and results of operations. The acquisitions may not result in the intended

benefits to our business, and we may not successfully evaluate or utilize the acquired products, technology, or personnel, or accurately forecast the financial impact of an acquisition transaction. The process of integrating an acquired company, business or technology could create unforeseen operating difficulties and expenditures. The areas where we face risks include:

- diversion of management time and focus from operating our business to acquisition integration challenges;
- consumer and industry acceptance of products and services offered by the acquired company;
- implementation or remediation of controls, procedures and policies at the acquired company;
- coordination of product, engineering and sales and marketing functions;
- retention of employees from the acquired company;
- liability for activities of the acquired company before the acquisition;
- litigation or other claims arising in connection with the acquired company; and
- impairment charges associated with goodwill and other acquired intangible assets.

For example, during the year ended December 31, 2018, we recognized a non-cash impairment charge of \$10.0 million related to a June 2017 equity investment and a non-cash impairment for \$69.0 million related to the indefinite-lived Trulia trade names and trademarks intangible asset.

Our failure to address these risks or other problems encountered in connection with our past or future acquisitions and investments could cause us to fail to realize the anticipated benefits of such acquisitions or investments, incur unanticipated liabilities, and harm our business, results of operations and financial condition.

***Our Fraud Detection Processes and Information Security Systems May Not Successfully Detect All Fraudulent Activity by Third Parties Aimed at Our Employees or Users of Our Mobile Applications and Websites, Which Could Adversely Affect Our Reputation and Business Results.***

Third-party actors have attempted in the past, and may attempt in the future, to conduct fraudulent activity by engaging with users of our mobile applications and websites by, for example, posting fake real estate listings on our sites and attempting to solicit personal information or money from users, and by engaging with our employees by, for example, making fake requests for transfer of funds. With the addition of our Zillow Offers and mortgage lending businesses, we now make a large number of wire transfers in connection with loan and real estate closings. Though we have sophisticated fraud detection processes and have taken other measures to identify fraudulent activity on our mobile applications, websites and internal systems, we may not be able to detect and prevent all such activity. Similarly, the third parties we use to effectuate these transactions may fail to maintain adequate controls or systems to detect and prevent fraudulent activity. Persistent or pervasive fraudulent activity may cause users and advertisers to lose trust in us and decrease or terminate their usage of our products and services, or could result in financial loss, thereby harming our business and results of operations.

***We Are Subject to Multiple Risks Related to the Credit Card and Debit Card Payments We Accept.***

We accept payments through credit and debit card transactions. For credit and debit card payments, we pay interchange and other fees, which may increase over time. An increase in those fees may require us to increase the prices we charge and would increase our operating expenses, either of which could harm our business, financial condition and results of operations.

We depend on processing vendors to complete credit and debit card transactions, both for payments owed to Zillow Group directly and for payments to other third-parties, such as payments made by renters to landlords in our rental payments product. If we or our processing vendors fail to maintain adequate systems for the authorization and processing of credit card transactions, it could cause one or more of the major credit card companies to disallow our continued use of their payment products. In addition, if these systems fail to work properly and, as a result, we do not charge our customers' credit cards on a timely basis or at all, our business, revenue, results of operations and financial condition could be harmed.

The payment methods that we offer also subject us to potential fraud and theft by criminals, who are becoming increasingly more sophisticated, seeking to obtain unauthorized access to or exploit weaknesses that may exist in the payment systems. If we fail to comply with applicable rules or requirements for the payment methods we accept, or if payment-related data are compromised due to a breach of data, we may be liable for significant costs incurred by payment card issuing banks and other third parties or subject to fines and higher transaction fees, or our ability to accept or facilitate certain types of



payments may be impaired. In addition, our customers could lose confidence in certain payment types, which may result in a shift to other payment types or potential changes to our payment systems that may result in higher costs. If we fail to adequately control fraudulent credit card transactions, we may face civil liability, diminished public perception of our security measures, and significantly higher credit card-related costs, each of which could harm our business, results of operations and financial condition.

We are also subject to payment card association operating rules, certification requirements and rules governing electronic funds transfers, which could change or be reinterpreted to make it more difficult for us to comply. We are required to comply with payment card industry security standards. Failing to comply with those standards may violate payment card association operating rules, federal and state laws and regulations, and the terms of our contracts with payment processors. Any failure to comply fully also may subject us to fines, penalties, damages and civil liability, and may result in the loss of our ability to accept credit and debit card payments. Further, there is no guarantee that such compliance will prevent illegal or improper use of our payment systems or the theft, loss, or misuse of data pertaining to credit and debit cards, card holders and transactions.

If we are unable to maintain our chargeback rate or refund rates at acceptable levels, our processing vendors may increase our transaction fees or terminate their relationships with us. Any increases in our credit and debit card fees could harm our results of operations, particularly if we elect not to raise our rates for our service to offset the increase. The termination of our ability to process payments on any major credit or debit card would significantly impair our ability to operate our business.

### **Risks Related to Our Intellectual Property and Technology**

#### ***If Our Security Measures or Technology Systems Are Compromised, We May Be Subject to Legal Claims and Suffer Significant Losses, and Consumers May Curtail Use of Our Products and Services and Advertisers May Reduce Their Advertising on Our Mobile Applications and Websites.***

Our products and services involve the transmission, processing, and/or storage of users' information, some of which may be private or include personally identifiable information such as social security numbers, financial account information, and credit card information. For example, our dotloop real estate transaction management software stores sensitive personal and financial information, our Mortech mortgage product and pricing software for mortgage professionals processes social security numbers, our rental applications product allows consumers to obtain credit and background checks containing sensitive personal and financial information, and MLOA, our mortgage origination business, receives, handles and transmits highly sensitive personal and financial information about its borrowers. Security breaches and administrative or technical failures could expose us to a risk of data loss or exposure, including both consumer and customer data as well as intellectual property and other confidential business information, which could result in potential significant liability and litigation. Like all mobile application and website providers, our mobile applications and websites are vulnerable to computer viruses, break-ins, phishing attacks, or other attacks, any of which could lead to loss of critical data or the unauthorized disclosure or use of personal or other confidential information. Further, outside parties may attempt to fraudulently induce employees, officers, directors, users or advertisers to disclose sensitive information in order to gain access to our information or our users' or advertisers' information, and our information technology and infrastructure may be vulnerable to attacks by hackers or breached due to user error, malfeasance or other disruptions. If we experience compromises to our security that result in the loss or unauthorized disclosure of confidential information, our users and advertisers may lose trust in us, users may decrease the use of our mobile applications or websites or stop using our mobile applications, websites, or services in their entirety, advertisers may decrease or stop advertising on our mobile applications or websites, and we may be subject to legal claims, government investigation and additional state and federal legal requirements.

We engage a variety of vendors to process and store certain user information, some of which may be private or include personally identifiable information. We also depend on vendors to host many of the systems and infrastructure used to provide our products and services. If our data storage vendors fail to maintain adequate information security systems and our systems or our users' information is compromised, our business, results of operations and financial condition could be harmed. A security breach at our vendor could be perceived by consumers or our customers as a breach of our systems and could result in damage to our reputation and expose us to other losses.



Further, because the techniques used to obtain unauthorized access, disable or degrade service, or sabotage systems change frequently, often are not recognized until launched against a target, and may originate from less regulated and remote areas around the world, we may be unable to proactively address all these techniques or to implement adequate preventative measures. Any or all of these issues could negatively impact our ability to attract new users and increase engagement by existing users, cause existing users to curtail or stop use of our products or services or close their accounts, cause existing advertisers to cancel their contracts, cause us to incur significant costs to notify affected individuals and upgrade our technology, or subject us to third-party lawsuits, regulatory fines or other action or liability, thereby harming our business, results of operations and financial condition.

***Any Significant Disruption in Service on Our Mobile Applications or Websites or in Our Network Could Damage Our Reputation and Brands, and Result in a Loss of Users of Our Products and Services and of Advertisers, Which Could Harm Our Business, Results of Operations and Financial Condition.***

Our brand, reputation and ability to attract users and advertisers depend on the reliable performance of our network infrastructure and content delivery processes. Our mobile applications and websites are exposed to attempts to overload our servers with denial-of-service attacks or similar disruptions from unauthorized use of our computer systems. We have experienced minor interruptions in these systems in the past, including server failures that temporarily slowed the performance of our mobile applications and websites, and we may experience interruptions in the future. Interruptions in these systems, whether due to system failures, computer viruses, software errors or physical or electronic break-ins, could affect the security or availability of our products and services on our mobile applications and websites and prevent or inhibit the ability of users to access our services. Since our users may rely on our products and services, including our customer relationship management tools, for important aspects of their businesses, problems with the reliability, availability or security of our systems could damage our users' businesses, harm our reputation, result in a loss of users of our products and services and of advertisers and result in additional costs, any of which could harm our business, results of operations and financial condition. In October 2016, for example, traffic to our websites zillow.com and trulia.com was impacted by a distributed denial of service attack against one of our domain name system providers. This incident did not have a material adverse effect on our business, and there is no indication that our internal controls were compromised. Despite the additional network detection tools and other processes we implemented, and our continual work to install new, and upgrade existing, information technology systems and provide employee awareness training around phishing, malware, and other cyber risks, we cannot ensure that we will not experience similar incidents in the future.

To deliver web and mobile Zillow Group brand content while ensuring scalability and redundancy, we utilize both third-party web services for cloud computing and storage and shared data centers in Seattle, Washington and Santa Clara, California.

We do not own or control the operation of certain of these facilities. Our systems and operations are vulnerable to damage or interruption from fire, flood, power loss, telecommunications failure, terrorist attacks, acts of war, electronic and physical break-ins, computer viruses, earthquakes and similar events. The occurrence of any of the foregoing events could result in damage to our systems and hardware or could cause them to fail completely, and our insurance may not cover such events or may be insufficient to compensate us for losses that may occur.

A failure of our systems at one site could result in reduced functionality for our users, and a total failure of our systems could cause our mobile applications or websites to be inaccessible. Problems faced by our third-party web-hosting providers with the telecommunications network providers with which they contract or with the systems by which they allocate capacity among their customers, including us, could adversely affect the experience of our users. Our third-party web-hosting providers could decide to close their facilities without adequate notice. Any financial difficulties, such as bankruptcy reorganization, faced by our third-party web-hosting providers or any of the service providers with whom they contract may have negative effects on our business, the nature and extent of which are difficult to predict. If our third-party web-hosting providers are unable to keep up with our growing needs for capacity, our business could be harmed. In addition, if distribution channels for our mobile applications experience disruptions, such disruptions could adversely affect the ability of users and potential users to access or update our mobile applications, which could harm our business.

We do not carry business interruption insurance sufficient to compensate us for the potentially significant losses, including the potential harm to the future growth of our business, which may result from interruptions in our service as a result of system failures. Any errors, defects, disruptions or other performance problems with our services could harm our reputation, business, results of operations and financial condition.

***We Rely Upon Certain Third-Party Services to Support Critical Functions of Our Business and Any Disruption of or Interference with our Use of those Third -Party Services Could Adversely Impact Our Operations and Our Business.***

A limited number of third-party services support essential functions of our business, including Amazon Web Services (“AWS”) and certain other Software-as-a-Service technologies hosted by third parties (“SaaS Services”). AWS provides us with a distributed computing infrastructure platform for business operations, which is commonly referred to as a “cloud” computing service. Certain of our computer systems utilize data processing, storage capabilities and other services provided by AWS, and we currently run the vast majority of computing to power our mobile applications, websites, and other technology products and services on AWS. In addition, we use SaaS Services to support important functions of our business, including enterprise resource planning and customer relationship management. We store a significant amount of information about our users, customers, employees, and business on AWS and in the SaaS Services, and we rely on these third-party service providers to provide services on a timely and effective basis. Their failure to perform as expected or as required by contract could result in significant disruptions and costs to our operations. In light of our reliance on AWS and SaaS Services, coupled with the complexity of obtaining replacement services, any disruption of or interference with our use of these third-party services could adversely impact our operations and business.

***We May Be Unable to Adequately Protect Our Intellectual Property, Which Could Harm the Value of Our Brands and Our Business.***

We regard our intellectual property as critical to our success, and we rely on trademark, copyright and patent law, trade secret protection and contracts to protect our proprietary rights. If we are not successful in protecting our intellectual property, the value of our brands and our business, results of operations and financial condition could be harmed.

While we believe that our issued patents and pending patent applications help to protect our business, we cannot ensure that our operations do not, or will not, infringe valid, enforceable patents of third parties or that competitors will not devise new methods of competing with us that are not covered by our patents or patent applications. We cannot ensure that our patent applications will be approved, that any patents issued will adequately protect our intellectual property, that such patents will not be challenged by third parties or found to be invalid or unenforceable, or that our patents will be effective in preventing third parties from utilizing a “copycat” business model to offer the same products or services. Our Zestimate home valuation, for example, which we consider to be a key competitive advantage with respect to consumer engagement, is currently protected by a patent, the loss of which could benefit comparable services provided by our competitors and result in decreased user traffic and engagement with our mobile applications and websites, thereby harming our results of operations and financial condition.

Effective trademark, service mark, copyright and trade secret protection may not be available in every country in which our products and services may be provided. The laws of certain countries do not protect proprietary rights to the same extent as the laws of the United States and, therefore, in certain jurisdictions, we may be unable to protect intellectual property and our proprietary technology adequately against unauthorized third-party copying or use, which could harm our competitive position. We have licensed in the past, and expect to license in the future, certain of our proprietary rights, such as trademarks or copyrighted material, to third parties. These licensees may take actions that might diminish the value of our proprietary rights or harm our reputation, even if we have agreements prohibiting such activity. Though certain of these third parties are obligated to indemnify us for breaches of our intellectual property rights, they may be unable to meet these obligations. In addition, we rely on intellectual property and technology developed or licensed by third parties, and we may not be able to obtain licenses and technologies from these third parties on reasonable terms or at all. Any of these events could harm our business, results of operations or financial condition.

In addition, we may actively pursue entities that infringe our intellectual property, including through legal action. Taking such action may be costly, and we cannot ensure that such actions will be successful. Any increase in the unauthorized use of

our intellectual property could make it more expensive for us to do business and harm our results of operations or financial condition.

***Intellectual Property Disputes Are Costly to Defend and Could Harm Our Business, Results of Operations, Financial Condition and Reputation.***

From time to time, we face allegations that we have infringed the trademarks, copyrights, patents and other intellectual property rights of third parties. We are currently subject to intellectual property infringement claims. These claims allege, among other things, that aspects of our technology infringe upon the plaintiffs' intellectual property. If we are not successful in defending ourselves against these claims, we may be required to pay damages and may be subject to injunctions, each of which could harm our business, results of operations, financial condition and reputation. As we grow our business and expand our operations, we expect that we will continue to be subject to intellectual property claims and allegations. Patent and other intellectual property disputes or litigation may be protracted and expensive, and the results are difficult to predict and may require us to stop offering certain products, services or features, purchase licenses that may be expensive to procure, or modify our products or services. In addition, patent or other intellectual property disputes or litigation may result in significant settlement costs. Any of these events could harm our business, results of operations, financial condition and reputation.

In addition, we use open source software in our services and will continue to use open source software in the future. From time to time, we may be subject to claims brought against companies that incorporate open source software into their products or services, claiming ownership of, or demanding release of, the source code, the open source software and/or derivative works that were developed using such software, or otherwise seeking to enforce the terms of the applicable open source license. These claims could also result in litigation, and we may be required to purchase a costly license or remove open source software, devote additional research and development resources to changing our products or services, make generally available the source code for our proprietary technology, or waive certain of our intellectual property rights, any of which would have a negative effect on our business and results of operations.

Even if these matters do not result in litigation or are resolved in our favor or without significant cash settlements, the time and resources necessary to resolve them could harm our business, results of operations, financial condition and reputation.

***We May Be Unable to Continue to Use the Domain Names That We Use in Our Business, or Prevent Third Parties From Acquiring and Using Domain Names That Infringe on, Are Similar to, or Otherwise Decrease the Value of Our Brand or Our Trademarks or Service Marks.***

We have registered domain names for our websites that we use in our business. If we lose the ability to use a domain name, we may incur significant expenses to market our products and services under a new domain name, which could harm our business. In addition, our competitors could attempt to capitalize on our brand recognition by using domain names similar to ours. Domain names similar to ours have been registered in the United States and elsewhere. We may be unable to prevent third parties from acquiring and using domain names that infringe on, are similar to, or otherwise decrease the value of our brand or our trademarks or service marks. Protecting and enforcing our rights in our domain names and determining the rights of others may require litigation, which could result in substantial costs and diversion of management's attention.

***Confidentiality Agreements With Employees and Others May Not Adequately Prevent Disclosure of Trade Secrets and Other Proprietary Information.***

In order to protect our technologies and strategic business and operations information, we rely in part on confidentiality agreements with our employees, independent contractors, vendors, licensees, and other third parties. These agreements may not effectively prevent disclosure of confidential information, including trade secrets, and may not provide an adequate remedy in the event of unauthorized disclosure of confidential information. The loss of trade secret protection could make it easier for third parties to compete with our products by copying functionality. Others may independently discover our trade secrets and proprietary information, and in such cases, we could not assert any trade secret rights against such parties. Further, if our employees, contractors or other third parties with whom we do business use intellectual property owned by others in their work for us, disputes may arise as to the rights in related or resulting know-how and inventions. Any changes in, or unfavorable interpretations of, intellectual property laws may compromise our ability to enforce our trade secret and intellectual property

rights. Costly and time-consuming litigation could be necessary to enforce and determine the scope of our proprietary rights, and failure to obtain or maintain protection of our trade secrets or other proprietary information could harm our business, results of operations, reputation and competitive position.

***We May Not Be Able to Halt the Operations of Websites That Aggregate or Misappropriate Our Data.***

From time to time, third parties have misappropriated our data through website scraping, robots or other means, and aggregated this data on their websites with data from other companies. In addition, copycat websites have misappropriated data on our network and attempted to imitate our brand or the functionality of our websites. When we have become aware of such websites, we have employed technological or legal measures in an attempt to halt their operations. We may not be able, however, to detect all such websites in a timely manner and, even if we could, technological and legal measures may be insufficient to halt their operations. In some cases, particularly in the case of websites operating outside of the United States, our available remedies may not be adequate to protect us against the impact of the operation of such websites. In addition, if such activity creates confusion among consumers or advertisers, our brands and business could be harmed. Regardless of whether we can successfully enforce our rights against the operators of these websites, any measures that we may take could require us to expend significant financial or other resources, which could harm our business, results of operations or financial condition.

**Risks Related to Regulatory Compliance and Legal Matters**

***We Are, and May in the Future Become, Subject to a Variety of International, Federal, State, and Local Laws, Many of Which Are Unsettled and Still Developing and Which Could Subject Us to Claims or Otherwise Harm Our Business.***

With offices and owned properties located throughout the United States and an office in Vancouver, British Columbia, we are currently subject to a variety of, and may in the future become subject to additional, international, federal, state, and local laws that are continuously evolving and developing, including laws regarding the real estate, rental and mortgage industries, mobile- and internet-based businesses and other businesses that rely on advertising, as well as privacy and consumer protection laws, including the Telephone Consumer Protection Act, the Telemarketing Sales Rule, the CAN-SPAM Act, the Fair Credit Reporting Act, the Canadian Anti-Spam Law, the Personal Information Protection and Electronic Documents Act, along with employment laws, including those governing wage and hour requirements; in connection with Zillow Offers, laws addressing the purchase, upgrade, and sale of homes, including those governing hazardous substances; and in connection with Mortgage Lenders of America, laws and regulations governing mortgage loan origination activities. These laws are complex and can be costly to comply with, require significant management time and effort, and subject us to claims, government enforcement actions, civil and criminal liability or other remedies, including suspension of business operations. These laws may conflict with each other, and if we comply with the laws of one jurisdiction, we may find that we are violating laws of another jurisdiction.

If we are unable to comply with these laws or regulations in a cost-effective manner, we may modify impacted products and services, which could require a substantial investment and loss of revenue, or cease providing the impacted product or service altogether. If we are found to have violated laws or regulations, we may be subject to significant fines, penalties, and other losses.

We assist with the processing of customer credit card transactions and consumer credit report requests, originate mortgage loans, buy and sell homes, and provide other product offerings, which results in us receiving or facilitating transmission of personally identifiable information. This information is increasingly subject to legislation and regulation in the United States. These laws and regulations are generally intended to protect the privacy and security of personal information, including credit card information that is collected, processed and transmitted. For example, the recently enacted California Consumer Privacy Act, which will become effective on January 1, 2020, will impose restrictions on companies' use of personal data. We could be adversely affected if government regulations require us to significantly change our business practices with respect to this type of information or if the third-parties that we engage with to provide processing and screening services violate applicable laws and regulations.

***We are From Time to Time Involved In, or May In the Future be Subject to, Claims, Suits, Government Investigations, and Other Proceedings That May Result In Adverse Outcomes.***

We are from time to time involved in, or may in the future be subject to, claims, suits, government investigations, and proceedings arising from our business, including actions with respect to intellectual property, privacy, consumer protection, information security, mortgage lending, real estate, environmental, data protection or law enforcement matters, tax matters, labor and employment, and commercial claims, as well as actions involving content generated by our users, shareholder derivative actions, purported class action lawsuits, and other matters, including those matters described in Part II, Item 8 in Note 19 under the subsection titled “Legal Proceedings” in our Notes to Consolidated Financial Statements in this Annual Report on Form 10-K. Such claims, suits, government investigations, and proceedings are inherently uncertain, and their results cannot be predicted with certainty. Regardless of the outcome, any such legal proceedings can have an adverse impact on us because of legal costs, diversion of management and other personnel, and other factors. In addition, it is possible that a resolution of one or more such proceedings could result in reputational harm, liability, penalties, or sanctions, as well as judgments, consent decrees, or orders preventing us from offering certain features, functionalities, products, or services, or requiring a change in our business practices, products or technologies, which could in the future materially and adversely affect our business, operating results and financial condition.

In some instances, third parties may have an obligation to indemnify us for liabilities related to litigation or governmental investigations, and they may be unable to, or fail to, fulfill such obligations. If such third parties failed to indemnify us, we would be financially responsible, which could adversely affect our financial condition and cash flow. For example, on October 31, 2018, Zillow Group’s wholly owned subsidiary, ZGM Holdco, Inc., acquired MLOA by way of purchase of the then-outstanding equity of MLOA. Prior to the acquisition, on February 2, 2018, a former MLOA employee, Beau Charbonneau, filed a complaint against MLOA in United States District Court for the District of Kansas. The complaint alleges, among other things, that MLOA improperly classified its team leader roles as exempt from the overtime provisions of the Fair Labor Standards Act and that it failed to pay its loan officers for all hours worked in excess of 40 hours in any work week. The complaint also asserts wage-related claims under the Kansas Wage Payment Act and under Kansas common law. On December 6, 2018, the court issued an order conditionally certifying the case as a collective action under the Fair Labor Standards Act and authorized the plaintiff’s attorneys to send notice of the case to impacted team leaders and loan officers advising them of the case and their opportunity to join as a plaintiff. The court has not made any determinations regarding the merits of the claims asserted in the complaint, nor has it found that the matter should be tried as a collective or class action. Zillow Group and its affiliates are indemnified for losses incurred in connection with this matter by certain of the prior stockholders of MLOA. Additionally, in accordance with the equity purchase agreement governing the acquisition of MLOA, any costs incurred related to this matter will be paid directly by those same certain prior stockholders of MLOA. Although we do not believe a loss to Zillow Group is probable, should the sellers of MLOA fail to indemnify us for losses related to this matter, our financial condition may be negatively impacted.

***The Requirements of Being a Public Company May Strain Our Resources and Distract Our Management, Which Could Make It Difficult to Manage Our Business.***

We are required to comply with various regulatory and reporting requirements, including those required by the SEC. Complying with these reporting and other regulatory requirements can be time-consuming and results in increased costs to us and could harm our business, results of operations and financial condition.

As a public company, we are subject to the reporting requirements of the Securities Exchange Act of 1934, as amended, or the Exchange Act. These requirements could strain our systems and resources. The Exchange Act also requires that we file annual, quarterly and current reports with respect to our business and financial condition. The Exchange Act requires that we maintain effective disclosure controls and procedures and internal control over financial reporting. To maintain and improve the effectiveness of our disclosure controls and procedures and internal control over financial reporting, we have committed significant resources, hired additional staff and provided additional management oversight. We have implemented additional procedures and processes for the purpose of addressing the standards and requirements applicable to public companies. For example, new revenue recognition guidance was issued by the Financial Accounting Standards Board (“FASB”), which we adopted on January 1, 2018, requiring additional personnel time and other costs to implement. In addition, we are investing



additional personnel time and other costs to implement new guidance on leases, which we adopted on January 1, 2019. Sustaining our growth will require us to commit additional management, operational and financial resources to identify new professionals to join us and to maintain appropriate operational and financial systems to adequately support expansion. These activities may divert management's attention from other business concerns and could make it difficult to manage our business, which could harm our business, results of operations, financial condition and cash flows. In addition, if we identify any material weaknesses in our internal controls, we could lose investor confidence in the accuracy and completeness of our financial reports, which would cause the market price of our capital stock to decline.

## **Risks Related to Our Financial Statements**

### ***We Incurred Significant Operating Losses in the Past and We May Not Be Able to Generate Sufficient Revenue to Be Profitable Over the Long Term.***

We have incurred significant net operating losses in the past and, as of December 31, 2018, we had an accumulated deficit of \$671.8 million. Although we have experienced significant growth in revenue, our revenue growth rate may decline in the future as the result of a variety of factors, including the maturation of our business. At the same time, we also expect our costs to increase in future periods as we continue to expend substantial financial resources to develop and expand our business, including with respect to:

- expansion of Zillow Offers
- expansion of our mortgage origination business
- product development;
- sales and marketing;
- technology infrastructure;
- strategic opportunities, including commercial relationships and acquisitions; and
- general and administrative expenses, including legal and accounting expenses related to being a public company.

These investments may not result in increased revenue or growth in our business. If we fail to continue to grow our revenue and overall business and to manage our expenses, we may incur significant losses in the future and not be able to achieve or maintain profitability.

### ***Servicing Our Debt Requires a Significant Amount of Cash, and We May Not Have Sufficient Cash Flow From Our Business to Pay Our Substantial Debt.***

Our ability to make scheduled payments of the principal of, to pay interest on or to refinance our indebtedness, including the remaining outstanding \$9.6 million aggregate principal under Trulia's Convertible Senior Notes due in 2020 (the "2020 Notes"), the \$460.0 million aggregate principal under our Convertible Senior Notes due in 2021 (the "2021 Notes"), and the \$373.8 million aggregate principal amount under our Convertible Senior Notes due in 2023 (the "2023 Notes"), depends on our future performance, which is subject to economic, industry, competitive and other factors beyond our control. Our business may not continue to generate cash flow from operations in the future sufficient to service our debt and make necessary capital expenditures. If we are unable to generate such cash flow, we may be required to adopt one or more alternatives, such as selling assets, restructuring debt or obtaining additional equity capital on terms that may be onerous or highly dilutive. Our ability to refinance our indebtedness will depend on the capital markets and our financial condition at such time. We may not be able to engage in any of these activities or engage in these activities on desirable terms, which could result in a default on our debt obligations.

### ***We May Need to Raise Additional Capital to Grow Our Business and We May Not Be Able to Raise Additional Capital on Terms Acceptable to Us, or At All.***

Growing and operating our business, including through the development of new and enhanced products and services, may require significant cash outlays, liquidity reserves and capital expenditures. If cash on hand, cash generated from operations and cash equivalents and investment balances are not sufficient to meet our cash and liquidity needs, we may need to seek additional capital and we may not be able to raise the necessary cash on terms acceptable to us, or at all. For example,



our Homes business will require significant cash to acquire, update and sell homes. We entered into two revolving credit facilities, one in July 2018 and another in January 2019, to support operations of the Homes business. In addition, our mortgage lending business will require significant cash to originate mortgages. Our acquisition of MLOA in October 2018 also includes the assumption of warehouse facilities to finance its mortgage origination activities. Financing arrangements we pursue or assume may require us to grant certain rights, take certain actions, or agree to certain restrictions, that could negatively impact our business. If additional capital is not available to us on terms acceptable to us or at all, we may need to modify our business plans, which would harm our ability to grow our operations.

***We Rely on Assumptions, Estimates, and Business Data to Calculate our Key Performance Indicators and Other Business Metrics, and Real or Perceived Inaccuracies in These Metrics May Harm our Reputation and Negatively Affect our Business.***

Certain of our performance metrics are calculated using third party applications or internal company data that have not been independently verified. While these numbers are based on what we believe to be reasonable calculations for the applicable period of measurement, there are inherent challenges in measuring such information. For example, our measurement of unique users and visits may be affected by applications that automatically contact our servers to access our mobile applications and websites with no user action involved, and this activity can cause our system to count the user associated with such a device as a unique user or as a visit on the day such contact occurs.

We regularly review and may adjust our processes for calculating our performance metrics to improve accuracy. Our measure of certain metrics may differ from estimates published by third parties or from similarly-titled metrics of our competitors due to differences in methodology. If real estate professionals, advertisers or investors do not perceive our unique users or visits to be an accurate representation of our user engagement, or if we discover material inaccuracies in our unique users or visits, our reputation may be harmed, and real estate professionals and advertisers may be less willing to allocate their resources to our products and services, which could negatively affect our business and operating results.

***We Expect Our Results of Operations to Fluctuate on a Quarterly and Annual Basis.***

Our revenue and results of operations could vary significantly from period to period and may fail to match expectations as a result of a variety of factors, some of which are outside our control. The other risk factors discussed in this “Risk Factors” section may contribute to the variability of our quarterly and annual results. In addition, our results may fluctuate as a result of fluctuations in the quantity of, and the price at which we are able to sell, our remnant advertising, seasonal variances of home sales, which historically peak in the spring and summer seasons, and the size and seasonal variability of our advertisers’ marketing budgets. The seasonal variance and cyclical nature of home sales may contribute to the variability of our revenue and results of operations for the Homes and mortgage lending businesses, in particular. As a result of the potential variations in our revenue and results of operations, period-to-period comparisons may not be meaningful and the results of any one period should not be relied on as an indication of future performance. In addition, our results of operations may not meet the expectations of investors or public market analysts who follow us, which may adversely affect our stock price.

***We Could Be Subject to Additional Income Tax Liabilities and Our Ability to Use Our Net Operating Loss Carryforwards and Certain Other Tax Attributes May Be Limited.***

We are subject to federal and state income taxes in the United States and in Canada. Tax laws, regulations, and administrative practices in various jurisdictions may be subject to significant change, with or without notice, due to economic, political, and other conditions, and significant judgment is required in evaluating and estimating these taxes. Our effective tax rates could be affected by numerous factors, such as entry into new businesses and geographies, changes to our existing business and operations, acquisitions and investments and how they are financed, changes in our stock price, changes in our deferred tax assets and liabilities and their valuation, and changes in the relevant tax, accounting, and other laws, regulations, administrative practices, principles, and interpretations. For example, On December 22, 2017, the U.S. government enacted comprehensive tax legislation under the Tax Cuts and Jobs Act (the “Tax Act”). The Tax Act makes broad and complex changes to the U.S. tax code, including but not limited to: (1) reducing the U.S. federal corporate tax rate from 35 percent to 21 percent; (2) requiring companies to pay a one-time transition tax on certain untaxed earnings of foreign subsidiaries; (3) generally eliminating U.S. federal income taxes on dividends from foreign subsidiaries; (4) eliminating the corporate alternative

minimum tax (“AMT”) and how AMT credits are utilized; and (5) the additional limitations on deducting executive compensation under IRC section 162(m); and (6) changing rules related to uses and limitations of net operating loss carryforwards created in tax years beginning after December 31, 2017.

The Tax Act significantly changes how the U.S. taxes corporations. The Tax Act requires complex computations to be performed that were not previously required in U.S. tax law, significant judgments to be made in interpretation of the provisions of the Tax Act and significant estimates in calculations, and the preparation and analysis of information not previously relevant or regularly produced. The U.S. Treasury Department, the IRS, and other standard-setting bodies have not implemented all relevant regulations or issued substantive guidance to-date and could interpret or issue guidance on how provisions of the Tax Act will be applied or otherwise administered that is different from our current interpretation.

As of December 31, 2018, we had federal net operating loss carryforwards of approximately \$1,081.7 million, state net operating loss carryforwards of approximately \$32.5 million (tax effected), and net tax credit carryforwards of approximately \$48.8 million. Under Sections 382 and 383 of the Internal Revenue Code, if a corporation undergoes an ownership change, the corporation’s ability to use its pre-change net operating loss carryforwards and other pre-change tax attributes, such as research tax credits, to offset its post-change income or income tax liability may be limited. In connection with our August 2013 public offering of our Class A Common stock, we experienced an ownership change that triggered Sections 382 and 383, which may limit our ability to utilize net operating loss and tax credit carryforwards. In connection with our February 2015 acquisition of Trulia, Trulia experienced an ownership change that triggered Section 382 and 383, which may limit Zillow Group’s ability to utilize Trulia’s net operating loss and tax credit carryforwards.

## **Risks Related to Ownership of Our Common and Capital Stock and Debt Instruments**

### ***Our Class A Common Stock and Class C Capital Stock Prices May Be Volatile, and the Value of an Investment in Our Class A Common Stock and Class C Capital Stock May Decline.***

An active, liquid and orderly market for our Class A common stock and Class C capital stock may not be sustained, which could depress the trading price of our Class A common stock and Class C capital stock. The trading price of our Class A common stock and Class C capital stock has at times experienced price volatility and may continue to be volatile. For example, since shares of our Class A common stock began trading in February 2015, the closing price of our Class A common stock has ranged from \$17.06 per share to \$65.21 per share (adjusted for the August 2015 stock split effected in the form of a dividend) through December 31, 2018. Since shares of our Class C capital stock began trading in August 2015, the closing price of our Class C capital stock has ranged from \$16.01 per share to \$65.57 per share through December 31, 2018. The market price of our Class A common stock and Class C capital stock could be subject to wide fluctuations in response to many of the risk factors discussed in this Annual Report on Form 10-K and others beyond our control, including:

- actual or anticipated fluctuations in our financial condition and results of operations;
- changes in projected operational and financial results;
- addition or loss of significant customers;
- actual or anticipated changes in our growth rate relative to that of our competitors;
- announcements by us or our competitors of significant acquisitions, strategic partnerships, joint ventures or capital-raising activities or commitments;
- announcements of technological innovations or new offerings by us or our competitors;
- additions or departures of key personnel;
- changes in laws or regulations applicable to our services;
- fluctuations in the valuation of companies perceived by investors to be comparable to us;
- the inclusion, exclusion, or deletion of our Class A common stock and Class C capital stock from any trading indices, such as the S&P 500 Index;
- issuance of new or updated research or reports by securities analysts;
- sales of our Class A common stock and Class C capital stock by us or our shareholders;

- issuances of our Class A common stock upon conversion of the 2020 Notes and issuances of our Class C capital stock upon conversion of our 2021 Notes;
- stock price and volume fluctuations attributable to inconsistent trading volume levels of our shares; and
- general economic and market conditions.

Furthermore, the stock markets in recent years have experienced extreme price and volume fluctuations that have affected and continue to affect the market prices of the equity securities of many companies. These fluctuations often have been unrelated or disproportionate to the operating performance of those companies. These broad market and industry fluctuations, as well as general economic, political and market conditions such as recessions, interest rate changes or international currency fluctuations, may negatively impact the market price of our Class A common stock and Class C capital stock. In the past, companies that have experienced volatility in the market price of their stock have been subject to securities class action litigation. We have in the past been and are currently the target of this type of litigation, and we may continue to be the target of this type of litigation in the future. Past, current, and future securities litigation against us could result in substantial costs and divert management's attention from other business concerns, which could harm our business, results of operations or financial condition.

***The Structure of Our Capital Stock as Contained in Our Charter Documents Has the Effect of Concentrating Voting Control With Our Founders, and Limits Your Ability to Influence Corporate Matters.***

Since Zillow Group's inception, our capital structure has included authorized Class A common stock and authorized Class B common stock. Our Class A common stock entitles its holder to one vote per share, and our Class B common stock entitles its holder to 10 votes per share. All shares of Class B common stock have been and are held or controlled by our founders, Richard Barton and Lloyd Frink. As of December 31, 2018, Mr. Barton's holdings and Mr. Frink's holdings represented approximately 31.5% and 20.5%, respectively, of the voting power of our outstanding capital stock.

For the foreseeable future, Mr. Barton and Mr. Frink will therefore have significant control over our management and affairs and will be able to control most matters requiring shareholder approval, including the election or removal (with or without cause) of directors and the approval of any significant corporate transaction, such as a merger or other sale of us or our assets. In addition, because our Class C capital stock carries no voting rights (except as required by applicable law or as expressly provided in our amended and restated articles of incorporation), the issuance of Class C capital stock (instead of Class A common stock) could prolong the duration of Mr. Barton's and Mr. Frink's relative ownership of our voting power. This concentrated control could delay, defer or prevent a change of control, merger, consolidation, takeover, or other business combination involving us that you, as a shareholder, may otherwise support. This concentrated control could also discourage a potential investor from acquiring our Class A common stock or Class C capital stock due to the limited voting power of such stock relative to the Class B common stock and might harm the market price of our Class A common stock and Class C capital stock.

***Future Sales of Our Stock in the Public Market Could Cause Our Stock Price to Decline.***

Our Class A common stock began trading on The Nasdaq Global Select Market on February 18, 2015, and our Class C capital stock began trading on The Nasdaq Global Select Market on August 17, 2015. We cannot predict the effect, if any, that market sales of shares or the availability of shares for sale will have on the prevailing trading price of our Class A common stock and Class C capital stock from time to time. There is currently no contractual restriction on our ability to issue additional shares, and all of our outstanding shares are generally freely tradable, except for shares held by our "affiliates" as defined in Rule 144 under the Securities Act, which may be sold in compliance with the volume restrictions of Rule 144. Sales of a substantial number of shares of our Class A common stock and Class C capital stock could cause our stock price to decline. In addition, we may in the future issue shares of Class C capital stock for financings, acquisitions or equity incentives. If we issue shares of Class C capital stock in the future, such issuances would have a dilutive effect on the economic interest of our Class A common stock.

***If Securities or Industry Analysts Do Not Publish Research or Publish Inaccurate or Unfavorable Research About Our Business, Our Class A Common Stock and Class C Capital Stock Price and Trading Volume Could Decline.***

The trading market for our Class A common stock and Class C capital stock depends in part on the research and reports that securities or industry analysts publish about our company. If few or no securities or industry analysts cover our company, the market price of our publicly-traded stock could be negatively impacted. If securities or industry analysts cover us and if one or more of such analysts downgrade our stock or publish inaccurate or unfavorable research about our business, our stock price would likely decline. If one or more of the analysts covering us fail to publish reports on us regularly, demand for our stock could decline, which could cause our stock price and trading volume to decline.

***If We Issue Additional Equity Securities or Issue Additional Convertible Debt to Raise Capital, It May Have a Dilutive Effect on Shareholders' Investment.***

If we raise additional capital through further issuances of equity or convertible debt securities, our existing shareholders could suffer significant dilution in their percentage ownership of us. Moreover, any new equity securities we issue could have rights, preferences and privileges senior to those of holders of our common stock.

***The Capped Call Transactions May Affect the Value of Our 2021 Notes, Our 2023 Notes, and Our Class C Capital Stock.***

In connection with the pricing of each of the 2021 Notes and 2023 Notes, we entered into capped call transactions with certain financial institutions (the "option counterparties"). The capped call transactions are expected generally to reduce the potential dilution upon conversion of the 2021 Notes or 2023 Notes and/or offset any cash payments we are required to make in excess of the principal amount of converted notes, as the case may be.

The option counterparties or their respective affiliates may modify their hedge positions by entering into or unwinding various derivative transactions with respect to our Class C capital stock and/or purchasing or selling our Class C capital stock or other securities of ours in secondary market transactions prior to the maturity of each of the 2021 Notes and 2023 Notes (and are likely to do so during any observation period related to a conversion of 2021 Notes or 2023 Notes or in connection with any repurchase of 2021 Notes or 2023 Notes by us). This activity could cause or avoid an increase or a decrease in the market price of our Class C capital stock, the 2021 Notes or the 2023 Notes.

***Anti-Takeover Provisions in Our Charter Documents and Under Washington Law Could Make an Acquisition of Us More Difficult, Limit Attempts by Shareholders to Replace or Remove Our Management and Affect the Market Price of Our Stock.***

Provisions in our articles of incorporation and bylaws, as amended and restated, may have the effect of delaying or preventing a change of control or changes in our management. Our amended and restated articles of incorporation or amended and restated bylaws include provisions, some of which will become effective only after the date, which we refer to as the threshold date, on which the Class B common stock controlled by our founders represents less than 7% of the aggregate number of shares of our outstanding Class A common stock and Class B common stock, that:

- set forth the structure of our capital stock, which concentrates voting control of matters submitted to a vote of our shareholders with the holders of our Class B common stock, which is held or controlled by our founders;
- authorize our board of directors to issue, without further action by our shareholders, up to 30,000,000 shares of undesignated preferred stock, subject, prior to the threshold date, to the approval rights of the holders of our Class B common stock;
- establish that our board of directors will be divided into three classes, Class I, Class II and Class III, with each class serving three-year staggered terms;
- prohibit cumulative voting in the election of directors;
- provide that, after the threshold date, our directors may be removed only for cause;
- provide that, after the threshold date, vacancies on our board of directors may be filled only by the affirmative vote of a majority of directors then in office or by the sole remaining director;

- provide that only our board of directors may change the board's size;
- specify that special meetings of our shareholders can be called only by the chair of our board of directors, our board of directors, our chief executive officer, our president or, prior to the threshold date, holders of at least 25% of all the votes entitled to be cast on any issue proposed to be considered at any such special meeting;
- establish an advance notice procedure for shareholder proposals to be brought before a meeting of shareholders, including proposed nominations of persons for election to our board of directors;
- require the approval of our board of directors or the holders of at least two-thirds of all the votes entitled to be cast by shareholders generally in the election of directors, voting together as a single group, to amend or repeal our bylaws; and
- require the approval of not less than two-thirds of all the votes entitled to be cast on a proposed amendment, voting together as a single group, to amend certain provisions of our articles of incorporation.

Prior to the threshold date, our directors can be removed with or without cause by holders of our Class A common stock and Class B common stock, voting together as a single group, and vacancies on the board of directors may be filled by such shareholders, voting together as a single group. Given the structure of our capital stock, our founders, Richard Barton and Lloyd Frink, who hold or control our Class B common stock, will have the ability for the foreseeable future to control these shareholder actions. See the risk factor above titled "The Structure of Our Capital Stock as Contained in Our Charter Documents Has the Effect of Concentrating Voting Control With our Founders, and Limits Your Ability to Influence Corporate Matters."

The provisions described above, after the threshold date, may frustrate or prevent any attempts by our shareholders to replace or remove our current management by making it more difficult for shareholders to replace members of our board of directors, which board is responsible for appointing our management. In addition, because we are incorporated in the State of Washington, we are governed by the provisions of Chapter 23B.19 of the Washington Business Corporation Act, which prohibits certain business combinations between us and certain significant shareholders unless specified conditions are met. These provisions may also have the effect of delaying or preventing a change of control of our company, even if this change of control would benefit our shareholders.

#### **Item 1B. Unresolved Staff Comments.**

Not applicable.

#### **Item 2. Properties.**

We have various operating leases for office space, which are summarized as of December 31, 2018 in the table below. We believe that our facilities are adequate for our current needs.

<u>Location</u>	<u>Purpose</u>	<u>Approximate Square Feet</u>	<u>Principal Lease Expiration Dates</u>
Seattle, Washington	Corporate headquarters for Zillow Group	307,237	2024
San Francisco, California	General office space	105,897	2023
Denver, Colorado	General office space	73,781	2021
Overland Park, Kansas	General office space	70,373	2024
Irvine, California	General office space	60,074	2022
New York, New York	General office space	53,200	2024

We lease additional office space in Chicago, Illinois, Cincinnati, Ohio, Lincoln, Nebraska, Atlanta, Georgia, Scottsdale, Arizona, Los Angeles, California, New York, New York and Vancouver, British Columbia. See Note 19 of Part II, Item 8 of this Annual Report on Form 10-K for more information about our lease commitments.

**Item 3. Legal Proceedings.**

For information regarding legal proceedings in which we are involved, see Note 19 under the subsection titled “Legal Proceedings” in our Notes to Consolidated Financial Statements in Part II, Item 8 of this Annual Report on Form 10-K.

**Item 4. Mine Safety Disclosures.**

Not applicable.



## PART II

### **Item 5. Market for Registrant’s Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities.**

#### **Market Information and Holders**

Our Class A common stock has traded on The Nasdaq Global Select Market under the symbol “ZG” since August 17, 2015 and under the symbol “Z” from July 20, 2011 through August 14, 2015.

Our Class B common stock is not listed and there is no established public trading market.

Our Class C capital stock has traded on The Nasdaq Global Select Market under the symbol “Z” since August 17, 2015. Prior to that time, there was no public market for our Class C capital stock.

#### **Holders of Record**

As of February 15, 2019, there were 90, three, and 134 holders of record of our Class A common stock, our Class B common stock, and our Class C capital stock, respectively.

#### **Dividends**

We have never declared or paid a cash dividend on our common or capital stock and we intend to retain all available funds and any future earnings to fund the development and growth of our business. We therefore do not anticipate paying any cash dividends on our common or capital stock in the foreseeable future. Any future determinations to pay dividends on our common or capital stock would depend on our results of operations, our financial condition and liquidity requirements, restrictions that may be imposed by applicable law or our contracts, and any other factors that our board of directors may consider relevant.

#### **Recent Sales of Unregistered Securities and Use of Proceeds from Registered Securities**

##### ***Recent Sales of Unregistered Securities***

There were no sales of unregistered securities during the year ended December 31, 2018.

#### **Purchases of Equity Securities by the Issuer**

None.

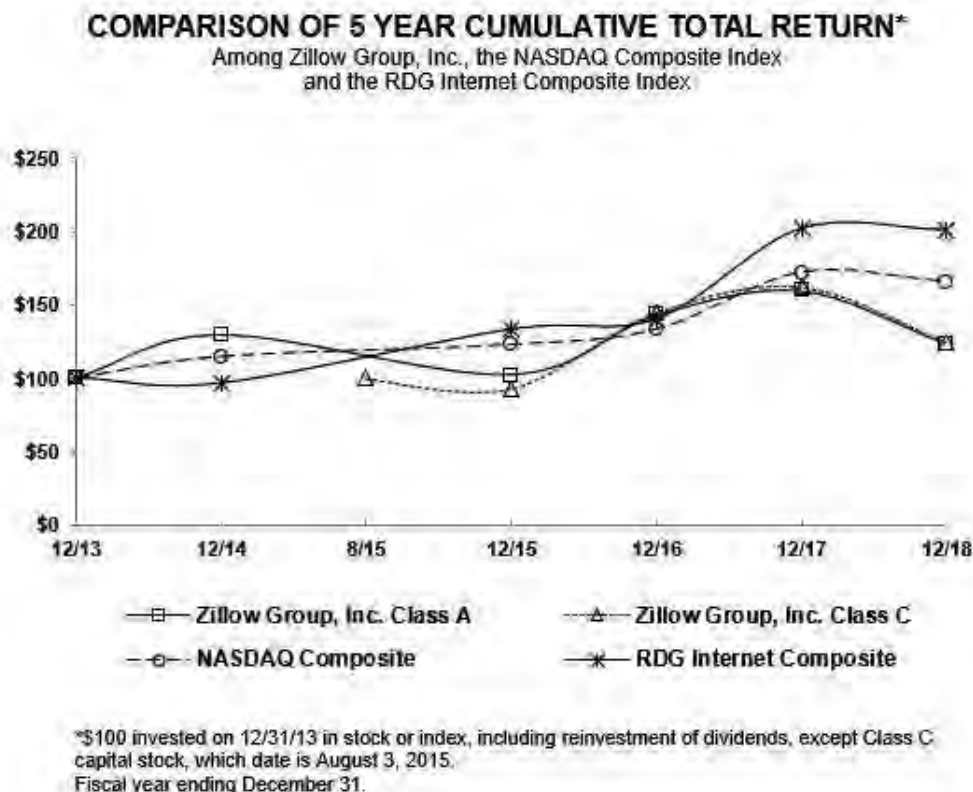
#### **Performance Graph**

The following graph compares our cumulative total shareholder return on Zillow Group’s common and capital stock with the Nasdaq Composite Index and the RDG Internet Composite Index.

For our Class A common stock, this graph covers the period from December 31, 2013 through December 31, 2018. This graph assumes that the value of the investment in Zillow Group’s Class A common stock and each index (including reinvestment of dividends) was \$100 on December 31, 2013.

For our Class C capital stock, this graph covers the period from August 3, 2015, using the closing price for the first day of trading during the when-issued trading period prior to the August 2015 stock split effected in the form of a dividend through December 31, 2018. This graph assumes that the value of the investment in Zillow Group’s Class C capital stock (including reinvestment of dividends) was \$100 on August 3, 2015.

The information contained in the graph is based on historical data and is not intended to forecast possible future performance.



#### Item 6. Selected Financial Data.

The selected financial data set forth below should be read in conjunction with the information under “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and our consolidated financial statements and related notes included elsewhere in this Annual Report on Form 10-K and our previously audited financial statements that are not included herein. We have included Trulia, Inc. in Zillow Group’s results of operations prospectively after February 17, 2015, the date of acquisition. We have given retroactive effect to prior period share and per share amounts in our consolidated statements of operations for the August 2015 stock split effected in the form of a dividend so that prior periods are comparable to current period presentation. Our historical results are not necessarily indicative of our results to be expected in any future period.

	Year Ended December 31,				
	2018	2017	2016	2015	2014
(in thousands, except per share data)					
<b>Statement of Operations Data:</b>					
Revenue:					
IMT	\$ 1,281,189	\$ 1,076,794	\$ 846,589	\$ 644,677	\$ 325,893
Homes	52,365	—	—	—	—
Total revenue	1,333,554	1,076,794	846,589	644,677	325,893
Cost of revenue (exclusive of amortization) (1)(2):					
IMT	104,330	85,203	69,262	60,127	29,461
Homes	49,260	—	—	—	—
Total cost of revenue	153,590	85,203	69,262	60,127	29,461
Sales and marketing (1)	552,621	448,201	382,419	308,125	169,462
Technology and development (1)	410,818	319,985	255,583	184,477	84,669
General and administrative (1)	262,153	210,816	332,007	184,984	65,503
Impairment and restructuring costs (1)	79,000	174,000	—	35,551	—
Acquisition-related costs	2,332	463	1,423	16,576	21,493
Integration costs	2,015	—	—	—	—
Loss (gain) on divestiture of businesses	—	—	(1,251)	4,368	—
Total costs and expenses	1,462,529	1,238,668	1,039,443	794,208	370,588
Loss from operations	(128,975)	(161,874)	(192,854)	(149,531)	(44,695)
Loss on debt extinguishment	—	—	(22,757)	—	—
Other income	19,270	5,385	2,711	1,501	1,085
Interest expense	(41,255)	(27,517)	(7,408)	(5,489)	—
Loss before income taxes	(150,960)	(184,006)	(220,308)	(153,519)	(43,610)
Income tax benefit (expense)	31,102	89,586	(130)	4,645	—
Net loss	\$ (119,858)	\$ (94,420)	\$ (220,438)	\$ (148,874)	\$ (43,610)
Net loss per share—basic and diluted	\$ (0.61)	\$ (0.51)	\$ (1.22)	\$ (0.88)	\$ (0.36)
Weighted average shares outstanding—basic and diluted	197,944	186,453	180,149	169,767	120,027
(1) Includes share-based compensation as follows:					
Cost of revenue	\$ 4,127	\$ 3,884	\$ 3,550	\$ 2,384	\$ 1,844
Sales and marketing	22,942	22,735	23,320	25,391	7,320
Technology and development	56,673	39,938	31,466	26,849	11,681
General and administrative	65,342	47,014	48,582	50,590	13,240
Impairment and restructuring costs	—	—	—	14,859	—
Total	\$ 149,084	\$ 113,571	\$ 106,918	\$ 120,073	\$ 34,085
(2) Amortization of website development costs and intangible assets included in technology and development					
	\$ 79,309	\$ 94,349	\$ 87,060	\$ 63,189	\$ 29,487

	At December 31,				
	2018	2017	2016	2015	2014
	(in thousands)				
Balance Sheet Data:					
Cash, cash equivalents and investments	\$ 1,554,925	\$ 762,539	\$ 507,515	\$ 520,289	\$ 455,920
Working capital	1,605,200	723,138	485,617	493,672	352,141
Property and equipment, net	135,172	112,271	98,288	85,523	41,600
Total assets	4,291,116	3,230,517	3,149,677	3,135,700	649,730
Long-term debt	699,020	385,416	367,404	230,000	—
Deferred tax liabilities and other long-term liabilities	17,474	44,561	136,146	132,482	—
Total shareholders' equity	3,267,179	2,660,823	2,533,587	2,679,053	588,779

**Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations.**

*The following discussion of our financial condition and results of operations should be read in conjunction with our audited consolidated financial statements and the related notes included elsewhere in this Annual Report on Form 10-K. In addition to historical financial information, the following discussion contains forward-looking statements that reflect our plans, estimates and beliefs. Our actual results may differ materially from those described in or implied by any forward-looking statements. Factors that could cause or contribute to these differences include those discussed below and elsewhere in this Annual Report on Form 10-K, particularly in the section titled "Risk Factors".*

**Overview of our Business**

Zillow Group, Inc. operates the largest portfolio of real estate and home-related brands on mobile and the web which focus on all stages of the home lifecycle: renting, buying, selling and financing. Zillow Group is committed to empowering consumers with unparalleled data, inspiration and knowledge around homes and connecting them with great real estate professionals. The Zillow Group portfolio of consumer brands includes Zillow, Trulia, Mortgage Lenders of America, StreetEasy, HotPads, Naked Apartments, RealEstate.com and Out East. Beginning in April 2018, the Zillow Offers service provides homeowners in select metropolitan areas with the opportunity to receive offers to purchase their homes from Zillow. When Zillow buys a home, it makes certain repairs and lists the home for resale on the open market. In addition, Zillow Group provides a comprehensive suite of marketing software and technology solutions to help real estate professionals maximize business opportunities and connect with millions of consumers. Zillow Group also operates a number of business brands for real estate, rental and mortgage professionals, including Mortech, dotloop, Bridge Interactive and New Home Feed.

**Reportable Segments and Revenue Overview**

As of the second quarter of 2018, Zillow Group has two reportable segments: the Internet, Media & Technology ("IMT") segment, our historical operating and reportable segment, and the Homes segment. In connection with our IMT segment, we generate revenue from the sale of advertising services and our suite of marketing software and technology solutions to businesses and professionals primarily associated with the residential real estate, rental and mortgage industries. These professionals include real estate, rental and mortgage professionals and brand advertisers. Our four primary revenue categories within our IMT segment are Premier Agent, Rentals, Mortgages and Other.

Premier Agent revenue is generated by the sale of advertising services, as well as marketing and technology products and services, to help real estate agents and brokers grow and manage their businesses. We offer these products and services through our Premier Agent and Premier Broker programs. Premier Agent and Premier Broker advertising products are primarily sold on a cost per impression basis. Impressions are delivered when a sold advertisement of a Premier Agent or Premier Broker appears on pages viewed by users of our mobile applications and websites.

Rentals revenue primarily includes advertising sold to property managers and other rental professionals on a cost per lead, cost per click or cost per lease generated basis. Beginning in 2018, rentals revenue also includes revenue generated through our rental applications product, whereby potential renters can submit applications to multiple properties over a 30-day period for a flat service fee.

Mortgages revenue primarily includes advertising sold to mortgage lenders and other mortgage professionals on a cost per lead basis, including our Connect (formerly known as Long Form) and Custom Quote services, as well as revenue generated by Mortech, which provides subscription-based mortgage software solutions, including a product and pricing engine and lead management platform. Beginning in October 2018, following our acquisition of Mortgage Lenders of America, L.L.C. ("MLOA"), mortgages revenue also includes revenue generated through mortgage originations and the sale of mortgages on the secondary market.

On October 31, 2018, we completed the acquisition of MLOA, a licensed mortgage lender. This acquisition is consistent with our strategy of providing services closer to real estate transactions to create better consumer experiences. The total

purchase price for the acquisition of MLOA is approximately \$66.7 million in cash. For additional information about the acquisition of MLOA, see Note 9 to our consolidated financial statements.

Other revenue primarily includes revenue generated by new construction and display advertising, as well as revenue from the sale of various other advertising and business technology solutions for real estate professionals, including dotloop. New construction revenue primarily includes advertising services sold to home builders on a cost per residential community basis. Display revenue primarily consists of graphical mobile and web advertising sold to advertisers promoting their brands on our mobile applications and websites.

In our Homes segment, we generate revenue from the resale of homes on the open market through our Zillow Offers service. We began buying homes through the Zillow Offers service in April 2018, and we began selling homes in July 2018.

Beginning with the Quarterly Report on Form 10-Q for the quarterly period ending March 31, 2019, Zillow Group expects to report financial results for three reportable segments: the IMT segment, the Homes segment and the Mortgages segment. The IMT segment will include the financial results for the Premier Agent, Rentals and new construction marketplaces, as well as dotloop, display and other advertising and business software solutions. The Homes segment will include the financial results from Zillow Group's buying and selling of homes directly through the Zillow Offers service. The Mortgages segment will include the financial results for advertising sold to mortgage lenders and other mortgage professionals, mortgage originations through MLOA and Motech mortgage software solutions. We expect the Mortgages segment, with the inclusion of MLOA, to have a material impact on our consolidated balance sheets, statements of operations and cash flows in 2019.

## Overview of Significant Milestones and Results

The following is a summary of certain of our significant milestones for the year ended December 31, 2018:

- In January, we launched Out East™, a new Hamptons-focused real estate brand. Out East replaces Hamptons Real Estate Online (HREO.com), which Zillow Group acquired in January 2017.
- In February, we launched a new national advertising campaign, “Many Ways Home”, with three national TV spots illustrating the diversity of the housing market today and the many different paths people take to find a new home.
- In March, we announced the top three teams from round one of our Zillow Prize competition, a machine learning competition to improve Zestimate accuracy, with a grand prize of up to \$1 million to the person or team who submits the most improved Zestimate algorithm model. In January 2019, we awarded the \$1 million prize to the winning team, which beat the Zillow benchmark model by approximately 13%.
- In March, we launched the “My Agent” feature, which creates an exclusive relationship between a Premier Agent and a home shopper on Zillow Group's mobile applications and websites.
- In April, we announced the launch of our Homes business, Zillow Offers. We believe the Zillow Offers service offers transparency, convenience and more choice for home sellers, and gives them certainty over their property sale price and timing of their move. As of December 31, 2018, the Zillow Offers service is available in Phoenix, Las Vegas, Atlanta, Denver, and Charlotte.
- In the second half of 2018, we made important changes to the Premier Agent and Premier Broker programs. For example, and as discussed in greater detail below, we implemented a new form of consumer lead validation and distribution to our Premier Agent and Premier Broker advertisers in an effort to deliver higher quality leads, which resulted in a decrease in the total number of leads received by some advertisers. The initial changes resulted in advertiser churn at a rate higher than we expected. Based on feedback from our Premier Agents and Premier Brokers, we subsequently made further adjustments to these processes, for example, by decreasing the number of screening questions posed to consumers as part of consumer lead validation, in an effort to return to prior lead volumes. We also implemented pricing caps in certain high-demand zip codes to help ease pressure on cost-per-lead.



increases resulting from growing demand in our auction-based pricing model. Beginning in the fourth quarter of 2018, we introduced Premier Agent and Premier Broker Flex Pricing products in a limited number of markets. With the Flex Pricing products, Premier Agents and Premier Brokers are provided validated consumer leads at no upfront cost and pay a performance advertising fee only when a real estate transaction is closed with one of their leads. We plan to expand this pricing model further in 2019.

- In June, we announced that we entered into an agreement to receive a direct listing feed from CENTURY 21 Canada to enable Zillow Group to feature Canadian listings on Zillow.com. We entered into additional listing agreements and marketing partnerships with other Canadian real estate enterprises throughout the year.
- In July, we introduced new tools for renters and landlords. Renters can apply for multiple rental units with one application, including background and credit reports and pay their rent through new features on Zillow.
- In July, we issued \$373.8 million aggregate principal amount of 1.50% Convertible Senior Notes due 2023 (the “2023 Notes”), which includes \$48.8 million principal amount of 2023 Notes sold pursuant to the underwriters’ option to purchase additional notes. We received net proceeds of \$364.0 million after deducting underwriting discounts and commissions and offering expenses payable by us. We used approximately \$29.4 million of the net proceeds from the issuance of the 2023 Notes to pay the cost of the Capped Call Confirmations. For additional information regarding the 2023 Notes, see Note 14 to our consolidated financial statements.
- In July, we issued and sold 6,557,017 shares (of which 855,263 shares were related to the exercise of the underwriters’ option to purchase additional shares) of our Class C capital stock at a public offering price of \$57.00 per share. We received net proceeds of \$360.3 million after deducting underwriting discounts and commissions and offering expenses payable by us. For additional information regarding the issuance, see Note 16 to our consolidated financial statements.
- In August, the company announced its entrance into a revolving credit agreement with Credit Suisse AG, Cayman Islands Branch, as the directing lender, and certain other parties thereto (the “Revolving Credit Facility”). The agreement provided for a maximum borrowing capacity of \$250.0 million with an initial borrowing capacity of \$20.0 million. On December 31, 2018 we increased the maximum borrowing capacity related to the Revolving Credit Facility to \$500.0 million. As of December 31, 2018, the Revolving Credit Facility had a current borrowing capacity of \$126.7 million.
- In October, we acquired MLOA, a licensed mortgage lender headquartered in Overland Park, Kansas.
- In October, we announced the “Best of Zillow” program, a data-driven program based on consumer feedback that will highlight real estate agent advertisers who provide exceptional customer service and reward them with additional marketing benefits such as designations as “Best of Zillow” or “Best of Trulia”.

For the years ended December 31, 2018, 2017, and 2016, we generated revenue of \$1,333.6 million, \$1,076.8 million and \$846.6 million, respectively, representing year-over-year growth of 24%, 27% and 31%, respectively. The increases in total revenue were primarily driven by growth in our Premier Agent program, which generated revenue of \$898.3 million, \$761.6 million, and \$604.3 million, respectively, for the years ended December 31, 2018, 2017 and 2016. We believe we were able to achieve these levels of revenue growth because of user traffic to and engagement with our mobile applications and websites, which create monetization opportunities for us through the sale of advertising and other products and services. The average number of monthly unique users for the three months ended December 31, 2018, 2017 and 2016 were 157.2 million, 151.6 million and 140.1 million, respectively, representing year-over-year growth of 4%, 8% and 13%, respectively. Visits for the years ended December 31, 2018, 2017 and 2016 were 7,182.1 million, 6,314.4 million and 5,323.2 million, respectively, representing year-over-year growth of 14%, 19% and 33%, respectively. This increase in visits increased the number of impressions we could monetize in our Premier Agent marketplace. Premier Agent revenue per visit for the years ended December 31, 2018, 2017 and 2016 was \$0.125, \$0.121 and \$0.114, respectively, representing year-over-year growth of 4%,

6% and 1%, respectively. We believe Premier Agent revenue was also positively impacted by market forces continuing to take effect within the auction-based pricing method we deployed for our Premier Agent and Premier Broker products in 2016 and 2017, which may have increased demand for our advertising platform. Total revenue also increased due to the launch of our Zillow Offers business in April 2018, which generated revenue of \$52.4 million for the year ended December 31, 2018 due to the sale of 177 homes at an average selling price of \$295.8 thousand per home.

## Employees

As of December 31, 2018, we had 4,336 full-time employees compared to 3,181 full-time employees as of December 31, 2017.

## Key Metrics

Management has identified unique users and visits as relevant to investors' and others' assessment of our financial condition and results of operations.

### *Unique Users*

Measuring unique users is important to us because much of our Premier Agent, Rentals, Mortgages and other advertising revenue depends in part on our ability to enable real estate, rental and mortgage professionals to connect with our consumer users - home buyers and sellers, renters, and individuals with or looking for a mortgage. Our display revenue depends in part on the number of impressions delivered to our users, and our Homes revenue depends in part on users accessing our mobile applications and websites to engage in the sale and purchase of homes with Zillow Group. Growth in consumer traffic to our mobile applications and websites increases the number of impressions, clicks, leads and other events we can monetize to generate revenue. In addition, our community of users improves the quality of our living database of homes with their contributions, which in turn attracts more users.

We count a unique user the first time an individual accesses one of our mobile applications using a mobile device during a calendar month and the first time an individual accesses one of our websites using a web browser during a calendar month. If an individual accesses our mobile applications using different mobile devices within a given month, the first instance of access by each such mobile device is counted as a separate unique user. If an individual accesses more than one of our mobile applications within a given month, the first access to each mobile application is counted as a separate unique user. If an individual accesses our websites using different web browsers within a given month, the first access by each such web browser is counted as a separate unique user. If an individual accesses more than one of our websites in a single month, the first access to each website is counted as a separate unique user since unique users are tracked separately for each domain. Zillow, StreetEasy, HotPads, Naked Apartments (as of March 2016) and RealEstate.com (as of June 2017) measure unique users with Google Analytics, and Trulia measures unique users with Adobe Analytics (formerly called Omniture analytical tools).

	Three Months Ended December 31.			2017 to 2018 % Change	2016 to 2017 % Change
	2018	2017	2016		
	(in millions)				
Average Monthly Unique Users	157.2	151.6	140.1	4%	8%

### *Visits*

The number of visits is an important metric because it is an indicator of consumers' level of engagement with our mobile applications, websites and other services. We believe highly engaged consumers are more likely to be transaction-ready real estate market participants and therefore more sought-after by our real estate professional advertisers or more likely to participate in our Zillow Offers program.

We define a visit as a group of interactions by users with the Zillow, Trulia, StreetEasy (as of March 2017) and RealEstate.com (as of June 2017) mobile applications and websites, as we monetize our Premier Agent and Premier Broker products on these mobile applications and websites. A single visit can contain multiple page views and actions, and a single

user can open multiple visits across domains, web browsers, desktop or mobile devices. Visits can occur on the same day, or over several days, weeks or months.

Zillow, StreetEasy and RealEstate.com measure visits with Google Analytics, and Trulia measures visits with Adobe Analytics. Visits to Trulia end after thirty minutes of user inactivity. Visits to Zillow, StreetEasy and RealEstate.com end either: (i) after thirty minutes of user inactivity or at midnight; or (ii) through a campaign change. A visit ends through a campaign change if a visitor arrives via one campaign or source (for example, via a search engine or referring link on a third-party website), leaves the mobile application or website, and then returns via another campaign or source.

	Year Ended December 31,			2017 to 2018	2016 to 2017
	2018	2017	2016	% Change	% Change
	(in millions)				
Visits	7,182.1	6,314.4	5,323.2	14%	19%

## Basis of Presentation

### *Revenue*

We recognize revenue when (or as) we satisfy our performance obligations by transferring control of promised products or services to our customers in an amount that reflects the consideration to which we expect to be entitled in exchange for those products or services.

In our IMT segment, we generate revenue from the sale of advertising services and our suite of marketing software and technology solutions to businesses and professionals primarily associated with the residential real estate, rental and mortgage industries. These professionals include real estate, rental and mortgage professionals and brand advertisers. Our four primary revenue categories within our IMT segment are Premier Agent, Rentals, Mortgages and Other.

In our Homes segment, we generate revenue from the resale of homes on the open market through our Zillow Offers program.

**Premier Agent Revenue.** Premier Agent revenue is derived from our Premier Agent and Premier Broker programs. Our Premier Agent and Premier Broker programs offer a suite of marketing and business technology products and services to help real estate agents and brokers achieve their advertising goals, while growing and managing their businesses and brands. All Premier Agents and Premier Brokers receive access to a dashboard portal on our mobile application or website that provides individualized program performance analytics, our customer relationship management, or CRM, tool that captures detailed information about each contact made with a Premier Agent or Premier Broker through our mobile and web platforms and our account management tools. We have concluded that the marketing and business technology products and services promised to Premier Agents and Premier Brokers represent distinct performance obligations.

We primarily offer our Premier Agent and Premier Broker advertising products on a cost per impression basis. Payment is received prior to the delivery of impressions. Impressions are delivered when a sold advertisement appears on pages viewed by users of our mobile applications and websites. We determine the cost per impression delivered in each zip code using an auction-based pricing method in consideration of the total amount spent by Premier Agents and Premier Brokers to purchase impressions in the zip code during the month. A Premier Agent's or Premier Broker's share of voice in a zip code is determined by their proportional monthly budgeted spend in that zip code as a percentage of the total monthly budgeted spend of all Premier Agents and Premier Brokers in that zip code. The cost per impression that we charge is dynamic - as demand for impressions in a zip code increases or decreases, the cost per impression in that zip code may be increased or decreased accordingly. The price paid for each impression is representative of the price at which we would sell an impression separately to a customer, or the stand-alone selling price.

We have not allocated the transaction price to each performance obligation as the amounts recognized would be the same irrespective of any allocation. As such, we recognize revenue related to the Premier Agent and Premier Broker products and services based on the contractual spend recognized on a straight-line basis during the contractual period over which the products and services are provided. This methodology best depicts how we satisfy our performance obligations to customers, as we continuously transfer control of the performance obligations to the customer throughout the contractual period.

In October 2018, we began testing a new Flex Pricing model for Premier Broker and Premier Agent advertising services in limited markets. With the Flex Pricing model, Premier Brokers and Premier Agents are provided with validated leads at no upfront cost, and they pay a performance advertising fee only when a real estate transaction is closed with one of their leads. With this pricing model, the transaction price represents variable consideration, as the amount to which we expect to be entitled varies based on the number of validated leads that convert into real estate transactions. As the amount of consideration is dependent upon factors outside our influence and our experience with this pricing model is limited, we fully constrain the estimated variable consideration. When a real estate transaction is closed with a Flex Pricing lead and payment is made, the uncertainty is resolved, and revenue is recognized in the period for the satisfied performance obligations.

**Rentals Revenue.** Rentals revenue includes the sale of advertising in our rentals information marketplace, as well as the sale of our suite of tools for rental professionals. Rentals revenue primarily includes revenue generated by advertising sold to property managers and other rental professionals on a cost per lead, cost per click or cost per lease generated basis. We recognize revenue as leads or clicks are provided to rental professionals, which is the amount for which we have the right to invoice. The number of leases generated through our rentals marketplace during the period is accounted for as variable consideration, and we estimate these amounts based on the expected number of qualified leases secured during the period. We do not believe that a significant reversal in the amount of cumulative revenue recognized will occur once the uncertainty related to the number of leases secured is subsequently resolved.

Beginning in 2018, rentals revenue also includes revenue generated from our rental applications product through which potential renters can submit applications to multiple rental properties over a 30-day period for a flat service fee. We recognize revenue for the rental applications product on a straight-line basis during the contractual period over which the customer has the right to access and submit the rental application.

**Mortgages Revenue.** Mortgages revenue primarily includes marketing products sold to mortgage professionals on a cost per lead basis, including our Custom Quote and a portion of our Connect services, and on a subscription basis, including a portion of our Connect service. Zillow Group operates Custom Quote and Connect through its wholly owned subsidiary, Zillow Group Marketplace, Inc., a licensed mortgage broker. For our Connect and Custom Quote cost per lead mortgage marketing products, participating qualified mortgage professionals typically make a prepayment to gain access to consumers interested in connecting with mortgage professionals. Mortgage professionals who exhaust their initial prepayment prepay additional funds to continue to participate in the marketplace. For our Connect subscription mortgage marketing product, participating qualified mortgage professionals generally prepay a monthly subscription fee, which they then allocate to desired geographic counties. In Zillow Group's Connect platform, consumers answer a series of questions to find a local lender, and mortgage professionals receive consumer contact information, or leads, when the consumer chooses to share their information with a lender. Consumers who request rates for mortgage loans in Custom Quotes are presented with customized quotes from participating mortgage professionals.

For our cost per lead mortgages products, we recognize revenue when a user contacts a mortgage professional through our mortgages platform, which is the amount for which we have the right to invoice. For our subscription product, the opportunity to receive a consumer contact is based on the mortgage professional's relative share of voice in a geographic county. When a consumer submits a contact, we contact a group of subscription mortgage professionals via text message, and the first mortgage professional to respond receives the consumer contact information. We recognize revenue based on the contractual spend recognized on a straight-line basis during the contractual period over which the service is provided. This methodology best depicts how we satisfy our performance obligation to subscription customers, as we continuously transfer control of the performance obligation to the customer throughout the contractual period.

Mortgages revenue also includes revenue generated by Mortech, which provides subscription-based mortgage software solutions, including a product and pricing engine and lead management platform, for which we recognize revenue on a straight-line basis during the contractual period over which the services are provided.

Beginning in the fourth quarter of 2018, mortgages revenue also includes revenue generated by our mortgage originations business. We elect the fair value option for our mortgage loans held for sale, which are initially recorded at fair value based on either sale commitments or current market quotes and are adjusted for subsequent changes in fair value until the loans are closed. Net origination costs and fees associated with mortgage loans are recognized as incurred at the time of origination. We sell substantially all of the mortgages we originate and the related servicing rights to third-party purchasers.

**Other Revenue.** Other revenue primarily includes revenue generated by new construction and display, as well as revenue from the sale of various other marketing and business products and services to real estate professionals. Our new construction marketing solutions allow home builders to showcase their available inventory to home shoppers. New construction revenue primarily includes revenue generated by advertising sold to builders on a cost per residential community basis, and revenue is recognized on a straight-line basis during the contractual period over which the communities are advertised on our mobile applications and websites. Consideration is billed in arrears. Display revenue primarily consists of graphical mobile and web



advertising sold on a cost per thousand impressions or cost per click basis to advertisers promoting their brands on our mobile applications and websites. We recognize display revenue as clicks occur or as impressions are delivered to users interacting with our mobile applications or websites, which is the amount for which we have the right to invoice.

**Homes Revenue.** Homes revenue is derived from the resale of homes on the open market through our Zillow Offers program. Homes revenue is recognized at the time of the closing of the home sale when title to and possession of the property are transferred to the buyer. The amount of revenue recognized for each home sale is equal to the full sale price of the home and does not reflect real estate agent commissions, closing or other costs associated with the transaction.

### ***Costs and Expenses***

**Cost of Revenue.** For our IMT segment, our cost of revenue consists of expenses related to operating our mobile applications and websites, including associated headcount expenses, such as salaries, benefits, bonuses, and share-based compensation expense, as well as credit card fees, ad serving costs paid to third parties, revenue-sharing costs related to our commercial business relationships, depreciation expense and costs associated with the operation of our data center and mobile applications and websites. Cost of revenue also includes expenses related to lead acquisition, systems directly used to originate mortgages and fees and processing costs incurred to originate mortgages.

For our Homes segment, our cost of revenue consists of the amount we pay to purchase each property, the costs of renovation we conduct on each property, associated headcount expenses, such as salaries, benefits, bonuses, and share-based compensation expense, as well as associated overhead costs.

**Sales and Marketing.** Sales and marketing expenses consist of advertising costs and other sales expenses related to promotional and marketing activities. Sales and marketing expenses also include headcount expenses, including salaries, commissions, benefits, share-based compensation expense and bonuses for sales, sales support, customer support, marketing and public relations employees, and for loan officers and specialists related to our mortgage originations business, and depreciation expense.

For our Homes segment, sales and marketing expenses also consist of selling costs, such as real estate agent commissions, escrow and title fees, and staging costs, as well as holding costs, including utilities, taxes and maintenance.

**Technology and Development.** Technology and development expenses consist of headcount expenses, including salaries, benefits, share-based compensation expense and bonuses for salaried employees and contractors engaged in the design, development and testing of our mobile applications and websites and the tools and applications that support our products. Technology and development expenses also include equipment and maintenance costs. Technology and development expenses also include amortization costs related to capitalized website and development activities, amortization of software, amortization of certain intangibles and other data agreement costs related to the purchase of data used to populate our mobile applications and websites, and amortization of intangible assets recorded in connection with acquisitions, including developed technology and customer relationships, amongst others. Technology and development expenses also include depreciation expense.

**General and Administrative.** General and administrative expenses consist of headcount expenses, including salaries, benefits, share-based compensation expense and bonuses for executive, finance, accounting, legal, human resources, recruiting, corporate information technology costs and other administrative support. General and administrative expenses also include legal settlement costs, legal, accounting and other third-party professional service fees, rent expense, depreciation expense and bad debt expense.

**Impairment Costs.** Impairment costs for the year ended December 31, 2018 consist of a \$10.0 million non-cash impairment related to our June 2017 equity investment and a \$69.0 million non-cash impairment related to the indefinite-lived Trulia trade names and trademarks intangible asset. For additional information about the impairments, see Note 9 and Note 11 to our consolidated financial statements.

**Acquisition-related Costs.** Acquisition-related costs consist of investment banking, legal, accounting, tax, and regulatory filing fees associated with acquisitions.

**Integration Costs.** Integration costs consist of expenses incurred to incorporate operations, systems, technology, and rights and responsibilities of acquired companies, during both pre-closing and post-closing periods, into Zillow Group's business. For the year ended December 31, 2018, integration costs primarily include consulting-related expenses incurred in connection with the acquisition of MLOA.

**Gain on Divestiture of Business.** The gain on divestiture of business recorded for the year ended December 31, 2016 consists of the gain recognized in connection with our August 2016 sale of our Diverse Solutions business.

#### ***Loss on Debt Extinguishment***

The loss on debt extinguishment recorded for the year ended December 31, 2016 relates to the partial repurchase of Trulia's Convertible Senior Notes due in 2020 (the "2020 Notes") in December 2016.

#### ***Other Income***

Other income consists primarily of interest income earned on our cash, cash equivalents and short-term investments.

#### ***Interest Expense***

Interest expense consists of interest on the 2020 Notes we guaranteed in connection with our February 2015 acquisition of Trulia, interest on the Convertible Senior Notes due in 2021 (the "2021 Notes") we issued in December 2016 and interest on the 2023 Notes we issued in July 2018. Interest is payable on the 2020 Notes at the rate of 2.75% semi-annually on June 15 and December 15 of each year. Interest is payable on the 2021 Notes at the rate of 2.00% semi-annually on June 1 and December 1 of each year. Interest is payable on the 2023 Notes at the rate of 1.50% semi-annually on January 1 and July 1 of each year.

Beginning in August 2018, interest expense includes interest on borrowings, funding fees and other fees, including the amortization of deferred issuance costs, on our revolving credit agreement with Credit Suisse AG, Cayman Islands Branch (the "Revolving Credit Facility") related to our Zillow Offers business. Borrowings on our Revolving Credit Facility bear interest at a floating rate based on LIBOR plus an applicable margin, as defined in the credit agreement governing the Revolving Credit Facility.

Beginning in October 2018, interest expense also includes interest on warehouse lines of credit acquired as part of the acquisition of MLOA. Each line of credit provides for a current and maximum borrowing capacity of \$50.0 million, or \$100.0 million in total. Borrowings on the lines of credit bear interest at either the one-month LIBOR rate plus an applicable margin, as defined in the credit agreement governing the line of credit, or the daily adjusting LIBOR rate plus an applicable margin, as defined in the credit agreement governing the warehouse line of credit.

#### ***Income Taxes***

We are subject to federal and state income taxes in the United States and in Canada. As of December 31, 2018 and December 31, 2017, we have provided a valuation allowance against our net deferred tax assets that we believe, based on the weight of available evidence, are not more likely than not to be realized. Therefore, no material current tax liability or expense has been recorded in the consolidated financial statements. We have accumulated federal tax losses of approximately \$1,081.7 million as of December 31, 2018, which are available to reduce future taxable income. We have accumulated state tax losses of approximately \$32.5 million (tax effected) as of December 31, 2018.

We recorded an income tax benefit of \$31.1 million for the year ended December 31, 2018. Approximately \$15.4 million of the income tax benefit relates to a \$69.0 million non-cash impairment we recorded during the year ended December 31, 2018 related to the indefinite-lived Trulia trade names and trademarks intangible asset. For additional information about the non-cash impairment, see Note 11 to our consolidated financial statements. The remaining portion of our income tax benefit is primarily the result of net operating losses generated after December 31, 2017 with an indefinite carryforward period due to the Tax Cuts and Jobs Act of 2017 ("the Tax Act"). Current year net operating losses can now offset against the indefinite-lived deferred tax liabilities which resulted in a release of the valuation allowance and a resulting income tax benefit.

During the year ended December 31, 2018, we completed our accounting for the income tax effects related to the deduction limitations on compensation under the Tax Act. The Internal Revenue Service provided further guidance in applying the written binding contracts requirement under the Tax Act, and we believe certain of our executive compensation previously eligible to be deductible for tax purposes under Section 162(m) of the Internal Revenue Code will be considered grandfathered and, therefore, will continue to be deductible. Based on the clarification of these rules, the accounting related to the Section 162(m) limitation of the Internal Revenue Code is considered complete and as a result we recorded a \$5.9 million tax benefit for the year ended December 31, 2018.

We recorded an income tax benefit of \$89.6 million for the year ended December 31, 2017. Approximately \$66.0 million of the income tax benefit relates to a \$174.0 million non-cash impairment we recorded during the year ended December 31, 2017 related to the \$351.0 million indefinite-lived intangible asset that we recorded in connection with our February 2015 acquisition of Trulia for Trulia's trade names and trademarks. For additional information about the non-cash impairment, see Note 11 to our consolidated financial statements. The remaining \$23.6 million of the income tax benefit primarily relates to our initial analysis of the impact of the rate decrease included in the Tax Act for the impact of the reduction in our net deferred tax liability related to our indefinite-lived intangible asset.

**Results of Operations**

The following tables present our results of operations for the periods indicated and as a percentage of total revenue:

	Year Ended December 31,		
	2018	2017	2016
	(in thousands, except per share data)		
Statements of Operations Data:			
Revenue:			
IMT	\$ 1,281,189	\$ 1,076,794	\$ 846,589
Homes	52,365	—	—
Total revenue	1,333,554	1,076,794	846,589
Cost of revenue (exclusive of amortization) (1)(2):			
IMT	104,330	85,203	69,262
Homes	49,260	—	—
Total cost of revenue	153,590	85,203	69,262
Sales and marketing (1)	552,621	448,201	382,419
Technology and development (1)	410,818	319,985	255,583
General and administrative (1)	262,153	210,816	332,007
Impairment costs	79,000	174,000	—
Acquisition-related costs	2,332	463	1,423
Integration costs	2,015	—	—
Gain on divestiture of business	—	—	(1,251)
Total costs and expenses	1,462,529	1,238,668	1,039,443
Loss from operations	(128,975)	(161,874)	(192,854)
Loss on debt extinguishment	—	—	(22,757)
Other income	19,270	5,385	2,711
Interest expense	(41,255)	(27,517)	(7,408)
Loss before income taxes	(150,960)	(184,006)	(220,308)
Income tax benefit (expense)	31,102	89,586	(130)
Net loss	\$ (119,858)	\$ (94,420)	\$ (220,438)
Net loss per share—basic and diluted	\$ (0.61)	\$ (0.51)	\$ (1.22)
Weighted-average shares outstanding—basic and diluted	197,944	186,453	180,149
Other Financial Data:			
Adjusted EBITDA (unaudited) (3)	\$ 200,832	\$ 236,315	\$ 14,826

(1) Includes share-based compensation as follows:

Cost of revenue	\$ 4,127	\$ 3,884	\$ 3,550
Sales and marketing	22,942	22,735	23,320
Technology and development	56,673	39,938	31,466
General and administrative	65,342	47,014	48,582
Total	\$ 149,084	\$ 113,571	\$ 106,918

(2) Amortization of website development costs and intangible assets included in technology and development

\$ 79,309	\$ 94,349	\$ 87,060
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(3) Adjusted EBITDA is a non-GAAP financial measure; it is not calculated or presented in accordance with U.S. generally accepted accounting principles, or GAAP. See “Adjusted EBITDA” below for more information and for a reconciliation of Adjusted EBITDA to net loss, the most directly comparable financial measure calculated and presented in accordance with GAAP. Adjusted EBITDA for the year ended December 31, 2016 includes the impact of the settlement of a lawsuit in June 2016 whereby the Company paid \$130.0 million in connection with a release of all claims.

	Year Ended December 31,		
	2018	2017	2016
<b>Percentage of Revenue:</b>			
Revenue			
IMT	96 %	100 %	100 %
Homes	4	0	0
Total revenue	100	100	100
Cost of revenue (exclusive of amortization):			
IMT	8	8	8
Homes	4	0	0
Total cost of revenue	12	8	8
Sales and marketing	41	42	45
Technology and development	31	30	30
General and administrative	20	20	39
Impairment costs	6	16	0
Acquisition-related costs	—	—	—
Integration costs	—	0	0
Gain on divestiture of business	0	0	—
Total costs and expenses	110	115	123
Loss from operations	(10)	(15)	(23)
Loss on debt extinguishment	0	0	(3)
Other income	1	1	—
Interest expense	(3)	(3)	(1)
Loss before income taxes	(11)	(17)	(26)
Income tax benefit (expense)	2	8	—
Net loss	(9)%	(9)%	(26)%

### ***Adjusted EBITDA***

To provide investors with additional information regarding our financial results, we have disclosed Adjusted EBITDA within this Annual Report on Form 10-K, a non-GAAP financial measure. We have provided a reconciliation below of Adjusted EBITDA to net loss, the most directly comparable GAAP financial measure.

We have included Adjusted EBITDA in this Annual Report on Form 10-K as it is a key metric used by our management and board of directors to measure operating performance and trends and to prepare and approve our annual budget. In particular, the exclusion of certain expenses in calculating Adjusted EBITDA facilitates operating performance comparisons on a period-to-period basis.

Our use of Adjusted EBITDA has limitations as an analytical tool, and you should not consider it in isolation or as a substitute for analysis of our results as reported under GAAP. Some of these limitations are:

- Adjusted EBITDA does not reflect our cash expenditures or future requirements for capital expenditures or contractual commitments;
- Adjusted EBITDA does not reflect changes in, or cash requirements for, our working capital needs;
- Adjusted EBITDA does not consider the potentially dilutive impact of share-based compensation;
- Although depreciation and amortization are non-cash charges, the assets being depreciated and amortized may have to be replaced in the future, and Adjusted EBITDA does not reflect cash capital expenditure requirements for such replacements or for new capital expenditure requirements;
- Adjusted EBITDA does not reflect impairment costs;
- Adjusted EBITDA does not reflect acquisition-related costs;



- Adjusted EBITDA does not reflect the gain on divestiture of business;
- Adjusted EBITDA does not reflect interest expense or other income;
- Adjusted EBITDA does not reflect the loss on debt extinguishment;
- Adjusted EBITDA does not reflect income taxes; and
- Other companies, including companies in our own industry, may calculate Adjusted EBITDA differently than we do, limiting its usefulness as a comparative measure.

Because of these limitations, you should consider Adjusted EBITDA alongside other financial performance measures, including various cash flow metrics, net loss and our other GAAP results.

The following table presents a reconciliation of Adjusted EBITDA to net loss for each of the periods presented:

	Year Ended December 31,		
	2018	2017	2016
	(in thousands, unaudited)		
<b>Reconciliation of Adjusted EBITDA to Net Loss:</b>			
Net loss	\$ (119,858)	\$ (94,420)	\$ (220,438)
Other income	(19,270)	(5,385)	(2,711)
Depreciation and amortization expense	99,391	110,155	100,590
Share-based compensation expense	149,084	113,571	106,918
Impairment costs	79,000	174,000	—
Acquisition-related costs	2,332	463	1,423
Gain on divestiture of business	—	—	(1,251)
Interest expense	41,255	27,517	7,408
Loss on debt extinguishment	—	—	22,757
Income tax (benefit) expense	(31,102)	(89,586)	130
Adjusted EBITDA (1)	<u>\$ 200,832</u>	<u>\$ 236,315</u>	<u>\$ 14,826</u>
(1) Adjusted EBITDA for the year ended December 31, 2016 includes the impact of the settlement of a lawsuit in June 2016 whereby the Company paid \$130.0 million in connection with a release of all claims.			

## Year Ended December 31, 2018 Compared to Year Ended December 31, 2017

### Revenue

The following table presents Zillow Group's revenue by category for the periods presented:

	<b>Year Ended December 31,</b>		<b>2017 to 2018 % Change</b>
	<b>2018</b>	<b>2017</b>	
	<b>(in thousands)</b>		
Premier Agent	\$ 898,332	\$ 761,594	18 %
Rentals	134,587	102,544	31 %
Mortgages	80,046	80,591	(1) %
Other	168,224	132,065	27 %
Homes	52,365	—	N/A
Total revenue	<u>\$ 1,333,554</u>	<u>\$ 1,076,794</u>	24 %

The following table presents Zillow Group's revenue categories as percentages of total revenue for the periods presented:

	<b>Year Ended December 31,</b>	
	<b>2018</b>	<b>2017</b>
<b>Percentage of Total Revenue:</b>		
Premier Agent	67%	71%
Rentals	10	10
Mortgages	6	7
Other	13	12
Homes	4	—
Total revenue	100%	100%

Total revenue increased by \$256.8 million, or 24%, for the year ended December 31, 2018 compared to the year ended December 31, 2017. There were approximately 157.2 million average monthly unique users of our mobile applications and websites for the three months ended December 31, 2018 compared to 151.6 million average monthly unique users for the three months ended December 31, 2017, representing year-over-year growth of 4%. Visits increased 14% to 7,182.1 million for the year ended December 31, 2018 from 6,314.4 million for the year ended December 31, 2017. The increases in unique users and visits increased the number of impressions, leads, clicks and other events we monetized across our revenue categories.

Premier Agent revenue grew to \$898.3 million for the year ended December 31, 2018 from \$761.6 million for the year ended December 31, 2017, an increase of \$136.7 million, or 18%. Premier Agent revenue represented 67% of total revenue for the year ended December 31, 2018 compared to 71% of total revenue for the year ended December 31, 2017. Premier Agent revenue was positively impacted by an increase in visits. As discussed above, visits increased 14% to 7,182.1 million for the year ended December 31, 2018 from 6,314.4 million for the year ended December 31, 2017. This increase in visits increased the number of impressions we could monetize in our Premier Agent marketplace. Premier Agent revenue per visit increased by 4% to \$0.125 for the year ended December 31, 2018 from \$0.121 for the year ended December 31, 2017. We calculate Premier Agent revenue per visit by dividing the revenue generated by our Premier Agent and Premier Broker programs in the period by the number of visits in the period. We believe Premier Agent revenue was also positively impacted by market forces continuing to take effect within the auction-based pricing method we deployed for our Premier Agent and Premier Broker products in 2016 and 2017, which may have increased demand for our advertising platform.

As discussed above, we made important changes to our Premier Agent and Premier Broker programs in 2018. For example, in April 2018, we began testing a new method of consumer lead validation and distribution to our Premier Agent and Premier Broker advertisers related to our auction-based pricing model. A validated consumer connection is made when a consumer who is interested in connecting with a real estate professional does not select a specific Premier Agent or Premier Broker with whom they want to connect through one of our mobile applications or websites. Applying the new model, these validated consumer leads are distributed to Premier Agents and Premier Brokers in proportion to their share of voice, or an agent advertiser's share of total advertising purchased in a particular zip code. With the new method of consumer lead distribution, the share of voice, purchased by Premier Agents and Premier Brokers represents both the share of impressions delivered as advertisements appearing on pages viewed by users of our mobile applications and websites, as well as the proportion of validated consumer connections a Premier Agent or Premier Broker receives. We believe distributing validated consumer connection leads in this manner creates better experiences for consumers and further strengthens our partnerships with real estate professionals. This transition to the new lead validation and distribution process resulted in a decrease in the total number of leads received by some advertisers and increased advertiser churn in the fourth quarter of 2018 as current and prospective Premier Agents and Premier Brokers evaluate the value of these higher-quality leads and market-based pricing continued to take effect. We believe we made appropriate adjustments to the Premier Agent and Premier Broker programs to help address this advertiser churn, for example, by decreasing the number of screening questions posed to consumers during the consumer lead validation process, in an effort to return to prior lead volumes.

We also implemented pricing caps in certain zip codes with high demand for Premier Agent and Premier Broker advertising to help moderate price increases resulting from market forces within our auction-based pricing model. As previously disclosed, we determine the price of Premier Agent and Premier Broker advertising services in each zip code using

an auction-based pricing method. The price we charge is dynamic - as advertiser demand for impressions in a zip code increases or decreases, the cost per impression we charge in that zip code may be increased or decreased accordingly.

In the fourth quarter of 2018, Premier Agent revenue also included an immaterial amount of revenue generated from our initial testing of a new Flex Pricing model for Premier Broker and Premier Agent advertisers in limited markets. With the Flex Pricing model, Premier Brokers and Premiers Agents are provided with validated leads at no upfront cost, and they pay a performance advertising fee only when a real estate transaction is closed with one of their leads. We expect to continue testing this pricing model in additional regions and may implement it more broadly in the future.

Advertiser response to these changes may negatively impact Premier Agent revenue in 2019. We are not able to predict whether these changes will have a material impact on our results in 2019 and beyond.

Rentals revenue was \$134.6 million for the year ended December 31, 2018 compared to \$102.5 million for the year ended December 31, 2017, an increase of \$32.0 million, or 31%. The increase in rentals revenue was primarily attributable to an increase in the number of average monthly rental listings on our mobile applications and websites, which increased 48% to 38,816 average monthly rental listings for the year ended December 31, 2018 from 26,315 average monthly rental listings for the year ended December 31, 2017. Average monthly rental listings include the average monthly monetized, deduplicated rental listings for the period, which are displayed across all of our mobile applications and websites. An increase in rental listings on our mobile applications and websites increases the likelihood that a consumer will contact a rental professional, which in turn increases the likelihood of a lead, click, lease or other event that we monetize. The increase in average monthly rental listings was primarily a result of our monetization of rental listings on our StreetEasy brand mobile application and website beginning in the third quarter of 2017. The quarterly revenue per average monthly rental listing decreased 11% to approximately \$867 for the year ended December 31, 2018 from approximately \$974 for the year ended December 31, 2017, due primarily to the monetization of rental listings on StreetEasy beginning in the third quarter of 2017, which typically generate less revenue per listing than larger rental properties. We calculate quarterly revenue per average monthly rental listing by dividing total rentals revenue for the period by the average monthly deduplicated rental listings for the period and then dividing by the number of quarters in the period. The increase in rentals revenue was also driven in part by the 14% increase in visits to 7,182.1 million for the year ended December 31, 2018, which similarly increases the likelihood a consumer will contact a rental professional, which in turn increases the likelihood of a lead, click, lease or other event that we monetize.

Mortgages revenue was \$80.0 million for the year ended December 31, 2018 compared to \$80.6 million for the year ended December 31, 2017, a decrease of \$0.5 million, or 1%. The decrease in mortgages revenue was primarily a result of decreased revenue generated by our Connect and Custom Quote services. In the first half of 2018, we began testing and implementation of a new consumer lead distribution model in select markets. Following full implementation of the new lead distribution model in 2018, we delivered more transaction-ready consumer connections to our advertising lenders, which we believe resulted in a more efficient experience for all participants. This change also resulted in certain advertising lenders receiving fewer consumer connections. We believe the decrease in revenue generated by our Connect service was primarily a result of the fewer consumer leads delivered in connection with our testing and initial implementation of the new consumer lead distribution model in select markets, as well as other product iterations across our sites which also led to a decrease in leads.

In addition, we believe rising mortgage interest rates in the United States have contributed to a decrease in monetization events within our lender advertising programs, primarily for our Custom Quote service, where we experienced lower refinance volumes than expected. We are uncertain how interest rates will impact mortgages revenue in future periods. The number of mortgage loan information requests submitted by consumers increased 12% to 25.4 million for the year ended December 31, 2018 from 22.7 million mortgage loan information requests submitted by consumers for the year ended December 31, 2017. This resulted in a 18% decrease in our average revenue per loan information request for the year ended December 31, 2018 compared to the year ended December 31, 2017. The growth in loan information requests submitted by consumers increases the likelihood of a monetization event, but there is not a direct correlation between the number of loan information requests and mortgage revenue because loan information requests do not always result in revenue recognition.

Beginning in the fourth quarter of 2018, mortgages revenue also included an immaterial amount of revenue generated from our mortgage originations business as a result of our acquisition of MLOA.

Other revenue was \$168.2 million for the year ended December 31, 2018 compared to \$132.1 million for the year ended December 31, 2017, an increase of \$36.2 million, or 27%. The increase in other revenue was primarily a result of a 55% increase in revenue generated by our new construction marketing solutions. Growth in new construction revenue was primarily attributable to increases in adoption by and advertising sales to new home builders through our new construction platform.

Homes revenue was \$52.4 million for the year ended December 31, 2018 due to the sale of 177 homes at an average selling price of \$295.8 thousand per home, which sales took place following the launch of our Zillow Offers business in April 2018. As of December 31, 2018, we held 509 homes in inventory, or approximately \$162.8 million in value.

## Year Ended December 31, 2017 Compared to Year Ended December 31, 2016

### Revenue

The following table presents Zillow Group's revenue by category for the periods presented:

	<b>Year Ended December 31,</b>		<b>2016 to 2017 % Change</b>
	<b>2017</b>	<b>2016</b>	
	<b>(in thousands)</b>		
<b>Revenue:</b>			
Premier Agent	\$ 761,594	\$ 604,292	26%
Rentals	102,544	60,976	68%
Mortgages	80,591	71,133	13%
Other	132,065	110,188	20%
Total revenue	<u>\$ 1,076,794</u>	<u>\$ 846,589</u>	27%

The following table presents Zillow Group's revenue categories as percentages of total revenue for the periods presented:

	<b>Year Ended December 31,</b>	
	<b>2017</b>	<b>2016</b>
<b>Percentage of Total Revenue:</b>		
Premier Agent	71%	71%
Rentals	10	7
Mortgages	7	8
Other	12	13
Total revenue	<u>100%</u>	<u>100%</u>

Overall revenue increased by \$230.2 million, or 27%, for the year ended December 31, 2017 compared to the year ended December 31, 2016. There were approximately 151.6 million average monthly unique users of our mobile applications and websites for the three months ended December 31, 2017 compared to 140.1 million average monthly unique users for the three months ended December 31, 2016, representing year-over-year growth of 8%. This increase in unique users increased the number of impressions and clicks we monetized across our revenue categories. In connection with the hurricanes that occurred during the summer of 2017, we worked closely with our Premier Agents and other advertisers in affected areas to help manage their advertising budgets. We estimate that relief initiatives, which included billing credits and other forms of advertiser assistance, as well as lost sales, impacted Premier Agent revenue by approximately \$2.0 million for the year ended December 31, 2017. We also experienced a temporary decline in traffic to our mobile applications and websites from consumers in impacted areas, which may have impacted the number of unique users and visits for the year ended December 31, 2017.

Premier Agent revenue grew to \$761.6 million for the year ended December 31, 2017 from \$604.3 million for the year ended December 31, 2016, an increase of \$157.3 million, or 26%. Premier Agent revenue represented 71% of total revenue for the year ended December 31, 2017 and 2016. Premier Agent revenue was positively impacted by an increase in visits. Visits increased 19% to 6,314.4 million for the year ended December 31, 2017 from 5,323.2 million for the year ended December 31, 2016. This increase in visits increased the number of impressions we could monetize in our Premier Agent marketplace.

Premier Agent revenue per visit increased by 6% to \$0.121 for the year ended December 31, 2017 from \$0.114 for the year ended December 31, 2016. We believe Premier Agent revenue was also positively impacted by the full implementation of the auction-based pricing method we deployed for our Premier Agent and Premier Broker products in 2016 and 2017, which may have increased demand for our advertising platform. During the year ended December 31, 2016, we began meaningful testing and implementation of a new auction-based pricing method for our Premier Agent product, our flagship advertising product, by which we determine the cost per impression delivered in each zip code in a dynamic way based on demand for impressions in that zip code. In the fourth quarter of 2016, we implemented this method broadly for all existing and new agent advertisers, including brokerages and other teams. We believe the increase in Premier Agent revenue was also due in part to increased advertising sales to current Premier Agents, including brokerages and other teams.

Rentals revenue was \$102.5 million for the year ended December 31, 2017 compared to \$61.0 million for the year ended December 31, 2016, an increase of \$41.6 million, or 68%. The increase in rentals revenue was partially attributable to an increase in the number of average monthly rental listings on our mobile applications and websites, which increased 62% to 26,315 average monthly rental listings for the year ended December 31, 2017 from 16,285 average monthly rental listings for the year ended December 31, 2016. The increase in average monthly rental listings was primarily driven by increases in our cost per lead and cost per click products. The revenue per average monthly rental listing increased 4% to approximately \$974 for the year ended December 31, 2017 from approximately \$936 for the year ended December 31, 2016.

Mortgages revenue was \$80.6 million for the year ended December 31, 2017 compared to \$71.1 million for the year ended December 31, 2016, an increase in 9.5 million, or 13%. The increase in mortgages revenue was primarily a result of a 54% increase in our average revenue per loan information request for the year ended December 31, 2017 compared to the year ended December 31, 2016. The increase in average revenue per loan information request was primarily a result of our flagship mortgage advertising platform, Long Form (now known as Connect), which yields higher revenue than our other mortgage advertising products, and increased consumer adoption of this platform, which was driven by product enhancements that allow us to monetize our mortgages products more efficiently. There were approximately 22.7 million mortgage loan information requests submitted on Zillow Group platforms by consumers for the year ended December 31, 2017 compared to 30.8 million mortgage loan information requests submitted on Zillow Group platforms by consumers for the year ended December 31, 2016, a decrease of 26%. We believe the decrease in the number of loan information requests submitted by consumers is due to our strategic decision to improve loan information request quality by requiring consumers to provide more information before a loan information request is submitted. We believe our mortgage product feature change creates a better experience for consumers and more valuable loan information requests for our lender advertisers.

Other revenue was \$132.1 million for the year ended December 31, 2017 compared to \$110.2 million for the year ended December 31, 2016, an increase of \$21.9 million, or 20%. The increase in other revenue was primarily a result of a 67% increase in revenue generated by our new construction marketing solutions. Growth in new construction revenue was primarily attributable to increases in adoption by and advertising sales to new home builders through our new construction platform.

**Year Ended December 31, 2018 Compared to Year Ended December 31, 2017****Segment Results of Operations**

The following table presents Zillow Group's segment results for the periods presented (in thousands):

	Year Ended December 31, 2018			Year Ended December 31, 2017		
	IMT	Homes	Consolidated	IMT	Homes	Consolidated
Revenue	\$ 1,281,189	\$ 52,365	\$ 1,333,554	\$ 1,076,794	\$ —	\$ 1,076,794
Costs and expenses:						
Cost of revenue	104,330	49,260	153,590	85,203	—	85,203
Sales and marketing	534,038	18,583	552,621	448,201	—	448,201
Technology and development	389,539	21,279	410,818	319,985	—	319,985
General and administrative	238,727	23,426	262,153	210,816	—	210,816
Impairment costs	79,000	—	79,000	174,000	—	174,000
Acquisition-related costs	2,332	—	2,332	463	—	463
Integration costs	2,015	—	2,015	—	—	—
Total costs and expenses	1,349,981	112,548	1,462,529	1,238,668	—	1,238,668
Income (loss) from operations	(68,792)	(60,183)	(128,975)	(161,874)	—	(161,874)
Other income	19,270	—	19,270	5,385	—	5,385
Interest expense	(39,078)	(2,177)	(41,255)	(27,517)	—	(27,517)
Loss before income taxes	\$ (88,600)	\$ (62,360)	\$ (150,960)	\$ (184,006)	\$ —	\$ (184,006)

**IMT Segment****Cost of Revenue**

Cost of revenue was \$104.3 million for the year ended December 31, 2018 compared to \$85.2 million for the year ended December 31, 2017, an increase of \$19.1 million, or 22%. The increase in cost of revenue was primarily attributable to an \$8.9 million increase in data center and connectivity costs, a \$5.9 million increase in credit card and ad serving fees, a \$3.0 million increase in headcount-related expenses, including share-based compensation expense, and a \$1.3 million increase in various miscellaneous expenses. We expect our cost of revenue to increase in absolute dollars in future years as we continue to incur more expenses associated with growth in revenue.

**Sales and Marketing**

Sales and marketing expenses were \$534.0 million for the year ended December 31, 2018 compared to \$448.2 million for the year ended December 31, 2017, an increase of \$85.8 million, or 19%. The increase in sales and marketing expenses was primarily attributable to increased headcount-related expenses of \$40.3 million, including share-based compensation expense, due primarily to significant growth in the size of our sales team.

In addition to the increase in headcount-related expenses, marketing and advertising expenses increased \$27.0 million, primarily related to advertising expenditures to attract consumers across online and offline channels, which supports our growth initiatives. The increase in sales and marketing expenses was also attributable to a \$9.8 million increase in tradeshow and conferences expense and related travel and client costs, a \$5.7 million increase in consulting costs to support our advertising initiatives, a \$1.4 million increase in depreciation expense and a \$0.9 million increase in software, hardware and connectivity costs. We expect our sales and marketing expenses to increase in absolute dollars in future years as we continue to invest more resources in extending our audience through marketing and advertising initiatives.



### ***Technology and Development***

Technology and development expenses, which include research and development costs, were \$389.5 million for the year ended December 31, 2018 compared to \$320.0 million for the year ended December 31, 2017, an increase of \$69.6 million, or 22%. Approximately \$66.8 million of the increase related to growth in headcount-related expenses, including share-based compensation expense, as we continue to grow our engineering teams to support current and future product initiatives. In addition, there was a \$10.2 million increase in other non-capitalizable data content expense, a \$4.5 million increase in professional services fees, a \$1.7 million increase in travel expenses, a \$1.5 million increase in software and hardware costs and a \$1.3 million increase in various miscellaneous expenses, partially offset by a \$16.4 million decrease in depreciation and amortization expense.

Other data content expense was \$45.6 million and \$35.4 million, respectively, for the year ended December 31, 2018 and 2017. Amortization expense included in technology and development related to intangible assets recorded in connection with acquisitions was \$35.3 million and \$40.0 million, respectively, for the year ended December 31, 2018 and 2017. Amortization expense included in technology and development for capitalized website development costs and software was \$33.6 million and \$44.4 million, respectively, for the years ended December 31, 2018 and 2017. Amortization expense included in technology and development for purchased data content intangible assets was \$10.0 million for the years ended December 31, 2018 and 2017. We expect our technology and development expenses to increase in absolute dollars over time as we continue to build new mobile and website functionality and invest in research and development of new technologies.

### ***General and Administrative***

General and administrative expenses were \$238.7 million for the year ended December 31, 2018 compared to \$210.8 million for the year ended December 31, 2017, an increase of \$27.9 million, or 13%. The increase in general and administrative expenses was primarily due to a \$28.7 million increase in headcount-related expenses, including share-based compensation expense, driven primarily by growth in headcount in shared corporate services to support our product and other teams, a \$7.9 million increase in software and hardware costs, a \$2.8 million increase in professional services fees, a \$2.5 million increase in travel expenses and a \$2.1 million increase in building lease-related expenses including rent, utilities and insurance, partially offset by a \$9.8 million decrease in estimated legal liabilities and a \$6.5 million decrease in bad debt expense. We expect general and administrative expenses to increase over time in absolute dollars as we continue to expand our business.

### ***Impairment Costs***

Impairment costs for the year ended December 31, 2018 consist of a \$10.0 million non-cash impairment related to our June 2017 equity investment and a \$69.0 million non-cash impairment related to the indefinite-lived Trulia trade names and trademarks intangible asset. Impairment costs for the year ended December 31, 2017 consisted of the \$174.0 million non-cash impairment related to the indefinite-lived Trulia trade names and trademarks intangible asset. For additional information about the impairments, see Note 9 and Note 11 to our consolidated financial statements.

### ***Acquisition-Related Costs***

Acquisition-related costs were \$2.3 million for the year ended December 31, 2018, primarily as a result of our October 2018 acquisition of MLOA. Acquisition-related costs were \$0.5 million for the year ended December 31, 2017, primarily as a result of our January 2017 acquisition of HREO and our September 2017 acquisition of New Home Feed.

### ***Integration Costs***

Integration costs were \$2.0 million for the year ended December 31, 2018 and primarily consisted of professional consulting service fees related to our October 2018 acquisition of MLOA. There were no integration costs for the year ended December 31, 2017.

### ***Interest Expense***

Interest expense was \$39.1 million for the year ended December 31, 2018, compared to \$27.5 million for the year ended December 31, 2017.

For the year ended December 31, 2018, interest expense primarily related to the 2021 Notes and the 2023 Notes, as well as interest on both the acquired MLOA warehouse lines of credit. As a result of the issuance of the 2023 Notes on July 3, 2018, we expect that our interest expense for the IMT segment will increase in future periods related to the contractual coupon interest and amortization of debt discount and debt issuance costs that will be recognized in interest expense. We also expect interest expense to increase in future periods in line with the expansion of our mortgage originations business.

For the year ended December 31, 2017, interest expense primarily related to the 2021 Notes that were issued on December 12, 2016. For additional information regarding the 2021 Notes and the 2023 Notes, see Note 14 to our consolidated financial statements.

## ***Homes Segment***

### ***Cost of Revenue***

Cost of revenue was \$49.3 million for the year ended December 31, 2018. Cost of revenue was primarily attributable to home acquisition and renovation costs related to the 177 homes that we sold during the year. We expect cost of revenue to increase in absolute dollars in future years as we continue to incur more expenses associated with growth in revenue and expansion of Zillow Offers into new geographic markets.

### ***Sales and Marketing***

Sales and marketing expenses were \$18.6 million for the year ended December 31, 2018. Sales and marketing expenses were primarily attributable to \$10.9 million in headcount-related expenses, including share-based compensation expense, \$2.3 million of selling expenses directly attributable to the resale of homes, \$1.9 million of holding costs, \$1.3 million of marketing and advertising expenses, \$1.0 million in tradeshow and conferences expense and related travel costs and \$1.2 million in miscellaneous expenses. We expect our sales and marketing expenses to increase in absolute dollars in future periods as we continue to expand the Homes segment.

### ***Technology and Development***

Technology and development expenses were \$21.3 million for the year ended December 31, 2018. Technology and development expenses were primarily due to \$19.8 million in headcount-related expenses, including share-based compensation expense and \$1.5 million in miscellaneous expenses, as we continue to grow our teams to support the Homes segment. We expect our technology and development expenses to increase in absolute dollars in future periods as we continue to build new website functionality and other technologies that will facilitate the purchasing and sales processes related to our Homes segment.

### ***General and Administrative***

General and administrative expenses were \$23.4 million for the year ended December 31, 2018. General and administrative expenses were primarily due to \$18.0 million in headcount-related expenses, including share-based compensation expense, as we continue to grow our teams to support the Homes segment. In addition, we incurred \$2.5 million in building lease-related expenses including rent, utilities and insurance, \$0.9 million in professional services fees, \$0.8 million in software and hardware costs and \$1.2 million in miscellaneous expenses. We expect general and administrative expenses to increase in absolute dollars in future periods as we continue to expand our Homes business.

**Year Ended December 31, 2017 Compared to Year Ended December 31, 2016****Segment Results of Operations**

The following table presents Zillow Group's segment results for the periods presented (in thousands):

	Year Ended December 31, 2017			Year Ended December 31, 2016		
	IMT	Homes	Consolidated	IMT	Homes	Consolidated
Revenue	\$ 1,076,794	\$ —	\$ 1,076,794	\$ 846,589	\$ —	\$ 846,589
Costs and expenses:						
Cost of revenue	85,203	—	85,203	69,262	—	69,262
Sales and marketing	448,201	—	448,201	382,419	—	382,419
Technology and development	319,985	—	319,985	255,583	—	255,583
General and administrative	210,816	—	210,816	332,007	—	332,007
Impairment costs	174,000	—	174,000	—	—	—
Acquisition-related costs	463	—	463	1,423	—	1,423
Gain on divestiture of business	—	—	—	(1,251)	—	(1,251)
Total costs and expenses	1,238,668	—	1,238,668	1,039,443	—	1,039,443
Loss from operations	(161,874)	—	(161,874)	(192,854)	—	(192,854)
Loss on debt extinguishment	—	—	—	(22,757)	—	(22,757)
Other income	5,385	—	5,385	2,711	—	2,711
Interest expense	(27,517)	—	(27,517)	(7,408)	—	(7,408)
Loss before income taxes	\$ (184,006)	\$ —	\$ (184,006)	\$ (220,308)	\$ —	\$ (220,308)

**IMT Segment****Cost of Revenue**

Cost of revenue was \$85.2 million for the year ended December 31, 2017 compared to \$69.3 million for the year ended December 31, 2016, an increase of \$15.9 million, or 23%. The increase in cost of revenue was primarily attributable to a \$7.9 million increase in revenue share costs, a \$4.8 million increase in data center and connectivity costs, a \$1.0 million increase in headcount-related expenses, including share-based compensation expense, a \$0.8 million increase in credit card and ad serving fees and a \$1.4 million increase in various miscellaneous expenses.

**Sales and Marketing**

Sales and marketing expenses were \$448.2 million for the year ended December 31, 2017 compared to \$382.4 million for the year ended December 31, 2016, an increase of \$65.8 million, or 17%. The increase in sales and marketing expenses was primarily attributable to increased marketing and advertising expenses of \$34.2 million, primarily related to advertising spend to attract consumers across online and offline channels, which supports our growth initiatives.

In addition to the increases in marketing and advertising, headcount-related expenses increased \$20.5 million, including share-based compensation expense, due primarily to significant growth in the size of our sales team. The increase in sales and marketing expenses was also attributable to a \$6.0 million increase in tradeshow and conferences expense and related travel costs, a \$2.5 million increase in consulting costs to support our advertising initiatives, a \$1.1 million increase in software, hardware and connectivity costs, and a \$1.5 million increase in various miscellaneous expenses.

### ***Technology and Development***

Technology and development expenses, which include research and development costs, were \$320.0 million for the year ended December 31, 2017 compared to \$255.6 million for the year ended December 31, 2016, an increase of \$64.4 million, or 25%. Approximately \$44.3 million of the increase related to growth in headcount-related expenses, including share-based compensation expense, as we continue to grow our engineering teams to support current and future product initiatives. In addition, there was a \$10.0 million increase in other non-capitalizable data content expense, a \$5.4 million increase in the amortization of purchased data content intangible assets, a \$1.3 million increase in amortization of acquired intangible assets, a \$1.1 million increase in software and hardware costs, and a \$2.3 million increase in various miscellaneous expenses.

Amortization expense included in technology and development for capitalized website development costs and software was \$44.4 million and \$43.8 million, respectively, for the year ended December 31, 2017 and 2016. Amortization expense included in technology and development related to intangible assets recorded in connection with acquisitions was \$40.0 million and \$38.7 million, respectively, for the year ended December 31, 2017 and 2016. Other data content expense was \$35.4 million and \$25.5 million, respectively, for the year ended December 31, 2017 and 2016. Amortization expense included in technology and development for purchased data content intangible assets was \$10.0 million and \$4.6 million, respectively, for the year ended December 31, 2017 and 2016.

### ***General and Administrative***

General and administrative expenses were \$210.8 million for the year ended December 31, 2017 compared to \$332.0 million for the year ended December 31, 2016, a decrease of \$121.2 million, or 37%. The decrease in general and administrative expenses was primarily a result of the settlement of a lawsuit with Move, Inc. and certain related entities (collectively, “Move”) in June 2016 whereby the Company paid \$130.0 million in connection with a release of all claims. In addition, there was a \$31.1 million decrease in professional services fees, primarily as a result of our settlement of litigation with Move, as we incurred \$28.8 million in legal costs related to our litigation with Move for the year ended December 31, 2016. These decreases were partially offset by a \$10.9 million increase in headcount-related expenses, including share-based compensation expense, driven primarily by growth in headcount in shared corporate services to support our engineering and other teams, a \$7.5 million increase in building lease-related expenses including rent, utilities and insurance, a \$6.0 million increase in estimated legal liabilities, a \$4.7 million increase in bad debt expense, a \$3.7 million increase in city and state taxes, a \$2.9 million increase in software and hardware costs, a \$2.0 million increase in the loss on disposal of assets, a \$1.0 million increase in travel expenses, and a \$1.2 million increase in miscellaneous general and administrative expenses.

### ***Impairment Costs***

Impairment costs for the year ended December 31, 2017 consist of the \$174.0 million non-cash impairment related to the \$351.0 million indefinite-lived intangible asset that we recorded in connection with our February 2015 acquisition of Trulia for Trulia’s trade names and trademarks. For additional information about the impairment, see Note 11 to our consolidated financial statements. There were no impairment costs for the year ended December 31, 2016.

### ***Acquisition-Related Costs***

Acquisition-related costs were \$0.5 million for the year ended December 31, 2017, primarily as a result of our January 2017 acquisition of HREO and our September 2017 acquisition of New Home Feed. Acquisition-related costs were \$1.4 million for the year ended December 31, 2016 as a result of our February 2016 acquisition of Naked Apartments and our August 2016 acquisition of Bridge Interactive.

### ***Gain on Divestiture of Business***

There was no gain on divestiture of business for the year ended December 31, 2017. The gain on divestiture of business of \$1.3 million for the year ended December 31, 2016 related to the August 2016 sale of our Diverse Solutions business.

***Loss on Debt Extinguishment***

There was no loss on debt extinguishment for the year ended December 31, 2017. The loss on debt extinguishment was \$22.8 million for the year ended December 31, 2016 and related to the partial repurchase of the 2020 Notes in December 2016.

***Interest Expense***

Interest expense was \$27.5 million for the year ended December 31, 2017, compared to \$7.4 million for the year ended December 31, 2016. For the year ended December 31, 2017, interest expense primarily related to the 2021 Notes that were issued on December 12, 2016. For the year ended December 31, 2016, interest expense primarily related to the 2020 Notes that we guaranteed in connection with the February 2015 acquisition of Trulia. For additional information regarding the 2020 Notes and the 2021 Notes, see Note 14 to our consolidated financial statements.

***Homes Segment***

We have not presented details for the Homes segment for the years ended December 31, 2017 and 2016 as we had only one operating and reportable segment prior to 2018.

## Quarterly Results of Operations

The following tables set forth our unaudited quarterly statements of operations data for each of the periods presented below. In the opinion of management, the data has been prepared on the same basis as the audited consolidated financial statements included in this Annual Report on Form 10-K, and reflects all necessary adjustments, consisting only of normal recurring adjustments, necessary for a fair presentation of the data. The results of historical periods are not necessarily indicative of the results of operations of any future period. You should read the data together with our consolidated financial statements and the related notes included elsewhere in this Annual Report on Form 10-K.

	Three Months Ended															
	December 31, 2018	September 30, 2018	June 30, 2018	March 31, 2018	December 31, 2017	September 30, 2017	June 30, 2017	March 31, 2017								
(in thousands, except per share data, unaudited)																
Statement of Operations Data:																
Revenue:																
IMT	\$	323,988	\$	332,076	\$	325,246	\$	299,879	\$	282,330	\$	281,839	\$	266,850	\$	245,775
Homes		41,347		11,018		—		—		—		—		—		—
Total revenue		365,335		343,094		325,246		299,879		282,330		281,839		266,850		245,775
Cost of revenue (exclusive of amortization) (1)(2):																
IMT		28,498		26,386		25,527		23,919		22,559		22,152		20,260		20,232
Homes		38,974		10,286		—		—		—		—		—		—
Total cost of revenue		67,472		36,672		25,527		23,919		22,559		22,152		20,260		20,232
Sales and marketing (1)		138,869		128,734		147,727		137,291		103,935		107,108		131,218		105,940
Technology and development (1)		111,195		105,314		100,376		93,933		85,187		83,389		78,541		72,868
General and administrative (1)		74,758		70,743		60,579		56,073		57,778		54,226		53,346		45,466
Impairment costs		69,000		10,000		—		—		174,000		—		—		—
Acquisition-related costs		268		1,405		632		27		97		218		43		105
Integration costs		1,492		523		—		—		—		—		—		—
Total costs and expenses		463,054		353,391		334,841		311,243		443,556		267,093		283,408		244,611
Income (loss) from operations		(97,719)		(10,297)		(9,595)		(11,364)		(161,226)		14,746		(16,558)		1,164
Other income		5,962		7,773		3,089		2,446		1,415		1,407		1,610		953
Interest expense		(14,327)		(12,668)		(7,187)		(7,073)		(6,991)		(6,906)		(6,897)		(6,723)
Income (loss) before income taxes		(106,084)		(15,192)		(13,693)		(15,991)		(166,802)		9,247		(21,845)		(4,606)
Income tax benefit (expense)		8,402		14,700		10,600		(2,600)		89,627		(41)		—		—
Net income (loss)	\$	(97,682)	\$	(492)	\$	(3,093)	\$	(18,591)	\$	(77,175)	\$	9,206	\$	(21,845)	\$	(4,606)
Net income (loss) per share—basic and diluted	\$	(0.48)	\$	—	\$	(0.02)	\$	(0.10)	\$	(0.41)	\$	0.05	\$	(0.12)	\$	(0.03)
Weighted-average shares outstanding—basic		203,561		202,416		194,155		191,464		189,439		187,692		185,439		183,158
Weighted-average shares outstanding—diluted		203,561		202,416		194,155		191,464		189,439		196,425		185,439		183,158
Other Financial Data:																
Adjusted EBITDA (3)	\$	32,357	\$	66,165	\$	56,000	\$	46,310	\$	70,859	\$	70,957	\$	39,700	\$	54,799



Three Months Ended									
	December 31, 2018	September 30, 2018	June 30, 2018	March 31, 2018	December 31, 2017	September 30, 2017	June 30, 2017	March 31, 2017	
(in thousands, unaudited)									
(1) Includes share-based compensation as follows:									
Cost of revenue	\$ 947	\$ 969	\$ 1,256	\$ 955	\$ 942	\$ 1,014	\$ 1,025	\$ 903	
Sales and marketing	5,529	5,911	6,340	5,162	5,041	5,914	6,250	5,530	
Technology and development	15,753	15,031	14,347	11,542	10,609	10,438	10,400	8,491	
General and administrative	15,489	19,771	17,000	13,082	12,817	11,208	11,518	11,471	
Total	\$ 37,718	\$ 41,682	\$ 38,943	\$ 30,741	\$ 29,409	\$ 28,574	\$ 29,193	\$ 26,395	
(2) Amortization of website development costs and intangible assets included in technology and development									
	\$ 17,575	\$ 18,165	\$ 21,020	\$ 22,549	\$ 24,392	\$ 23,537	\$ 23,159	\$ 23,261	

- (3) Adjusted EBITDA is a non-GAAP financial measure; it is not calculated or presented in accordance with GAAP. See “Adjusted EBITDA” below for more information and for a reconciliation of Adjusted EBITDA to net income (loss), the most directly comparable financial measure calculated and presented in accordance with GAAP.

The following tables present our revenue by type and as a percentage of total revenue for the periods presented:

Three Months Ended									
	December 31, 2018	September 30, 2018	June 30, 2018	March 31, 2018	December 31, 2017	September 30, 2017	June 30, 2017	March 31, 2017	
(in thousands, unaudited)									
<b>Revenue:</b>									
Premier Agent	\$ 221,012	\$ 232,703	\$ 230,885	\$ 213,732	\$ 199,514	\$ 197,054	\$ 189,725	\$ 175,301	
Rentals	34,917	37,319	33,288	29,063	28,851	28,438	23,710	21,545	
Mortgages	23,280	18,438	19,305	19,023	18,516	20,869	20,936	20,270	
Other	44,779	43,616	41,768	38,061	35,449	35,478	32,479	28,659	
Homes	41,347	11,018	—	—	—	—	—	—	
Total Revenue	\$ 365,335	\$ 343,094	\$ 325,246	\$ 299,879	\$ 282,330	\$ 281,839	\$ 266,850	\$ 245,775	

Three Months Ended									
	December 31, 2018	September 30, 2018	June 30, 2018	March 31, 2018	December 31, 2017	September 30, 2017	June 30, 2017	March 31, 2017	
<b>Percentage of Revenue:</b>									
Premier Agent	60%	68%	71%	71%	71%	70%	71%	71%	
Rentals	10	11	10	10	10	10	9	9	
Mortgages	6	5	6	6	7	7	8	8	
Other	12	13	13	13	13	13	12	12	
Homes	11	3	—	—	—	—	—	—	
Total revenue	100%	100%	100%	100%	100%	100%	100%	100%	

Total revenue increased sequentially in all quarters presented. In general, the strong increase in consumer adoption of our mobile applications and websites in the years ended December 31, 2018 and December 31, 2017 was reflected in the growth in unique users and visits, which resulted in increased impression inventory, leads, and graphical display impressions we could monetize through our advertising products.

Premier Agent revenue also increased sequentially in all quarters presented with the exception of the three months ended December 31, 2018. As discussed above, during the year ended December 31, 2016, we began meaningful testing and implementation of a new auction-based pricing method for our Premier Agent product, our flagship advertising product, by which we determine the cost per impression delivered in each zip code in a dynamic way based on demand for impressions in that zip code. We believe Premier Agent revenue was positively impacted by the full implementation of the new pricing method for our Premier Agent product, which may have increased the demand for our advertising platform through the third quarter of 2018. We believe the decline in revenue in the three months ended December 31, 2018 was driven by certain changes we made to the Premier Agent and Premier Broker programs in the second half of 2018 as discussed in Results of Operations above.

The quarter-over-quarter increases in revenue in 2018 were also attributable to growth in rentals revenue. Growth in rentals revenue was primarily attributable to increases in consumer adoption of our rentals information marketplaces, which in turn increased the likelihood of a lead, lease, click, or other event that we monetize, and advertiser adoption of our cost per lead, cost per lease and cost per click advertising products, as well as enhancements to our marketing products that improve the ways in which consumers and advertisers connect through the Zillow Group Rentals marketplace. Rentals revenue also increased as a result of our monetization of rental listings on our StreetEasy brand mobile application and website beginning in the third quarter of 2017. Additionally, rentals revenue increased as a result of the launch of our rental applications product in 2018 which allows prospective renters to submit rental applications online through Zillow.com for a flat service fee.

Other revenue was positively impacted by increased advertising sales to new home builders through our new construction platform.

The quarter-over-quarter increases in revenue in 2018 were also attributable to the launch of our Zillow Offers business in April 2018, with the first Zillow homes sold in July 2018 and with 141 homes sold in the fourth quarter of 2018, as well as our acquisition of MLOA in the fourth quarter of 2018.

### Seasonality

Portions of our business may be affected by seasonal fluctuations in the residential real estate market, advertising spending, and other factors. We believe our rapid growth may be masking the underlying seasonality of our business. As our revenue growth rate related to our IMT segment slows, we expect seasonal variances may become more pronounced, causing our operating results to fluctuate. For example, costs and expenses typically peak in the three months ended June 30th, primarily attributable to increases in sales and marketing expenses which are, in turn, primarily attributable to increased investment in marketing and advertising initiatives to attract consumers during peak seasons for home sales activity. In addition, the average number of unique users and visits have historically peaked during the three months ended June 30th or September 30th, consistent with peak residential real estate activity in the spring and summer months. Because the number of unique users and visits may impact impression inventory, leads to real estate professionals, and graphical display inventory which we monetize, this trend in the average number of unique users and visits may result in seasonality of revenue. We may begin to observe Premier Agent revenue peaking in the three months ended June 30th or September 30th, also in line with peak residential real estate activity in the spring and summer seasons. With respect to our Homes segment, the rate of revenue growth as we expand into new geographic markets may mask seasonality in revenue; we may, for example, be able to more quickly sell homes during the spring and summer high seasons.

### Adjusted EBITDA

The following table sets forth a reconciliation of Adjusted EBITDA to net income (loss) for each of the periods presented below. See “Adjusted EBITDA” under “Results of Operations” above in this Item 7 for additional information about why we have included Adjusted EBITDA in this Annual Report on Form 10-K and how management uses Adjusted EBITDA.

	Three Months Ended							
	December 31, 2018	September 30, 2018	June 30, 2018	March 31, 2018	December 31, 2017	September 30, 2017	June 30, 2017	March 31, 2017
	(in thousands, unaudited)							
Reconciliation of Adjusted EBITDA to Net Income (Loss):								
Net income (loss)	\$ (97,682)	\$ (492)	\$ (3,093)	\$ (18,591)	\$ (77,175)	\$ 9,206	\$ (21,845)	\$ (4,606)
Other income	(5,962)	(7,773)	(3,089)	(2,446)	(1,415)	(1,407)	(1,610)	(953)
Depreciation and amortization expense	23,090	23,375	26,020	26,906	28,579	27,419	27,022	27,135
Share-based compensation expense	37,718	41,682	38,943	30,741	29,409	28,574	29,193	26,395
Impairment costs	69,000	10,000	—	—	174,000	—	—	—
Acquisition-related costs	268	1,405	632	27	97	218	43	105
Interest expense	14,327	12,668	7,187	7,073	6,991	6,906	6,897	6,723
Income tax (benefit) expense	(8,402)	(14,700)	(10,600)	2,600	(89,627)	41	—	—
Adjusted EBITDA	\$ 32,357	\$ 66,165	\$ 56,000	\$ 46,310	\$ 70,859	\$ 70,957	\$ 39,700	\$ 54,799

### Unique Users

The following table sets forth the average number of unique users for each of the periods presented below. Refer to “Unique Users” above in this Item 7 for information about how we measure unique users. The average number of unique users has historically peaked during the three months ended June 30 or September 30, consistent with seasonal variances of home sales which generally peak in the spring and summer months.

	Average for the Three Months Ended							
	December 31, 2018	September 30, 2018	June 30, 2018	March 31, 2018	December 31, 2017	September 30, 2017	June 30, 2017	March 31, 2017
	(in millions)							
Unique Users	157.2	186.6	186.1	175.5	151.6	175.2	178.1	166.6

### Visits

The following table sets forth our visits for each of the periods presented below. Refer to “Visits” above in this Item 7 for information about how we measure visits. Consistent with the trend in our unique users discussed above, the number of visits has historically peaked during the three months ended June 30 or September 30, consistent with seasonal variances of home sales which generally peak in the spring and summer months.

	Three Months Ended							
	December 31, 2018	September 30, 2018	June 30, 2018	March 31, 2018	December 31, 2017	September 30, 2017	June 30, 2017	March 31, 2017
	(in millions)							
Visits	1,607.8	1,888.9	1,920.6	1,764.8	1,435.6	1,667.1	1,678.7	1,533.0

### Liquidity and Capital Resources

As of December 31, 2018 and 2017, we had cash, cash equivalents, investments and restricted cash of \$1,567.3 million and \$762.5 million, respectively. Cash and cash equivalents balances consist of operating cash on deposit with financial institutions, money market funds, corporate notes and bonds, commercial paper, U.S. government agency securities and certificates of deposit with original maturities of three months or less. Investments consist of fixed income securities, which include U.S. government agency securities, corporate notes and bonds, commercial paper, municipal securities, foreign government securities and certificates of deposit. Restricted cash consists of amounts funded to the reserve and collection accounts related to our Revolving Credit Facility (described below). Beginning in the fourth quarter of 2018, restricted cash also includes amounts held in escrow related to funding home purchases in our mortgage originations business. Amounts on deposit with third-party financial institutions exceed the Federal Deposit Insurance Corporation and the Securities Investor Protection Corporation insurance limits, as applicable. We believe that cash from operations and cash and cash equivalents and investment balances will be sufficient to meet our ongoing operating activities, working capital, capital expenditures and other capital requirements for at least the next 12 months.

The implementation and expansion of Zillow Group’s purchase of homes in the Zillow Offers program and sale of homes on the open market will likely have a significant impact on our liquidity and capital resources as a cash and inventory intensive initiative. During the second quarter of 2018, we used cash from our balance sheet to fund the purchases of homes and related costs. Beginning in the third quarter of 2018, we used debt financing to fund a portion of the purchase price of homes and certain related costs. On July 31, 2018, certain wholly owned subsidiaries of Zillow Group entered into a Revolving Credit Facility. The Revolving Credit Facility provided for an initial maximum borrowing capacity of \$250.0 million. This borrowing capacity was increased to \$500.0 million effective December 31, 2018 (the “Maximum Amount”) and has a current borrowing capacity of \$126.7 million as of December 31, 2018, which amount may be increased up to the Maximum Amount subject to the satisfaction of certain conditions. The Revolving Credit Facility is a non-recourse credit facility secured by a pledge of the equity of certain Zillow Group subsidiaries that purchase and sell select residential properties through Zillow Offers. The Revolving Credit Facility has an initial term of one year which may be extended for up to two additional years, subject to agreement by the directing lender. Beginning in August 2018, we incurred interest on borrowings on the Revolving Credit Facility at a floating rate based on LIBOR plus an applicable margin, as defined in the credit agreement governing the

Revolving Credit Facility. The Revolving Credit Facility includes customary representations and warranties, covenants (including financial covenants applicable to the Company), and provisions regarding events of default. For additional information regarding the Revolving Credit Facility, see Note 14 to our consolidated financial statements.

The October 31, 2018 acquisition of MLOA will likely have a significant impact on our liquidity and capital resources as a cash intensive business as it relates to funding mortgage loans originated for resale in the secondary market. In conjunction with the acquisition of MLOA, we acquired two non-recourse warehouse lines of credit which we use to fund a portion of mortgage loans originated. The borrowing capacity of the first line of credit is \$50.0 million as of December 31, 2018 and accrues interest at a floating rate based on LIBOR plus an applicable margin, as defined in the credit agreement governing the warehouse line of credit. The borrowing capacity on the second line of credit is \$50.0 million and accrues interest at a floating rate based on LIBOR plus an applicable margin, as defined in the credit agreement governing the warehouse line of credit. Both warehouse lines of credit include customary representations and warranties, covenants and provisions regarding events of default. For additional information regarding these warehouse lines of credit, see Note 14 to our consolidated financial statements.

In anticipation of the expected phaseout of LIBOR in 2021, we have performed an initial analysis of the impact the phaseout will have on the company, in particular with respect to the Revolving Credit Facility and warehouse lines of credit associated with MLOA. We do not believe the phaseout will have a material impact on the company, in part because the Revolving Credit Facility includes a mechanism for the parties thereto to select an alternative index, and the warehouse lines of credit are typically renewed annually, providing several opportunities for the parties thereto to select an alternative reference index before the LIBOR phaseout.

We have outstanding \$9.6 million aggregate principal of 2020 Notes as of December 31, 2018. The 2020 Notes were guaranteed by Zillow Group in connection with our February 2015 acquisition of Trulia, Inc. The aggregate principal amount of the 2020 Notes is due on December 15, 2020 if not earlier converted or redeemed. The 2020 Notes are convertible into shares of Zillow Group Class A common stock. Interest is payable on the 2020 Notes at the rate of 2.75% semi-annually on June 15 and December 15 of each year. Holders of the 2020 Notes may convert all or any portion of their notes, in multiples of \$1,000 principal amount, at their option at any time prior to the close of business on the business day immediately preceding the maturity date. The 2020 Notes are redeemable, at our option, in whole or in part as of December 20, 2018, under certain circumstances. For additional information regarding the 2020 Notes, see Note 14 to our consolidated financial statements.

In December 2016, Zillow Group issued \$460.0 million aggregate principal amount of 2021 Notes. The 2021 Notes bear interest at a fixed rate of 2.00% per year, payable semi-annually in arrears on June 1 and December 1 of each year. The 2021 Notes are convertible into cash, shares of our Class C capital stock or a combination thereof, at the Company's election. The 2021 Notes will mature on December 1, 2021, unless earlier repurchased, redeemed, or converted in accordance with their terms. Prior to the close of business on the business day immediately preceding September 1, 2021, the 2021 Notes are convertible at the option of the holders of the 2021 Notes only under certain conditions, none of which conditions have been satisfied as of December 31, 2018. On or after September 1, 2021, until the close of business on the second scheduled trading day immediately preceding the maturity date, holders of the 2021 Notes may convert their 2021 Notes at their option at the conversion rate then in effect, irrespective of these conditions. The Company will settle conversions of the 2021 Notes by paying or delivering, as the case may be, cash, shares of Class C capital stock, or a combination of cash and shares of Class C capital stock, at its election. The conversion rate will initially be 19.0985 shares of Class C capital stock per \$1,000 principal amount of 2021 Notes (equivalent to an initial conversion price of approximately \$52.36 per share of Class C capital stock). The conversion rate is subject to customary adjustments upon the occurrence of certain events. The Company may redeem for cash all or part of the 2021 Notes, at its option, on or after December 6, 2019, under certain circumstances at a redemption price equal to 100% of the principal amount of the 2021 Notes to be redeemed, plus accrued and unpaid interest to, but excluding, the redemption date (as defined in the indenture governing the 2021 Notes). For additional information regarding the 2021 Notes, see Note 14 to our consolidated financial statements.

On July 3, 2018, we closed underwritten public offerings of (1) 6,557,017 shares of Class C capital stock of Zillow Group, which includes 855,263 shares sold pursuant to the underwriters' option to purchase additional shares; and (2) \$373.8

million aggregate principal amount of Convertible Senior Notes due 2023 (the “2023 Notes”), which includes \$48.8 million principal amount of 2023 Notes sold pursuant to the underwriters’ option to purchase additional 2023 Notes. The net proceeds from the offering of Class C capital stock and the issuance of the 2023 Notes were \$360.3 million and \$364.0 million, respectively, after deducting underwriting discounts and commissions and offering expenses payable by Zillow Group. We used \$29.4 million of the net proceeds from the issuance of the 2023 Notes to pay the cost of capped call confirmations. We intend to use the remainder of the net proceeds for general corporate purposes, which may include general and administrative matters and capital expenditures. Additionally, we may choose to use a portion of the net proceeds to expand our current business through acquisitions of, or investments in, other businesses, products or technologies.

The 2023 Notes bear interest at a fixed rate of 1.50% per year, payable semi-annually in arrears on January 1 and July 1 of each year, beginning on January 1, 2019. Beginning in July 2018, interest expense included interest on the 2023 Notes. The 2023 Notes are convertible into cash, shares of Class C capital stock or a combination thereof, at the Company’s election. The 2023 Notes will mature on July 1, 2023, unless earlier repurchased, redeemed, or converted in accordance with their terms. Prior to the close of business on the business day immediately preceding April 1, 2023, the 2023 Notes are convertible at the option of the holders only under certain conditions. On or after April 1, 2023, until the close of business on the second scheduled trading day immediately preceding the maturity date, holders may convert their 2023 Notes at their option at the conversion rate then in effect, irrespective of these conditions. The Company will settle conversions of the 2023 Notes by paying or delivering, as the case may be, cash, shares of the Company’s Class C capital stock, or a combination of cash and shares of Class C capital stock, at its election. The conversion rate will initially be 12.7592 shares of Class C capital stock per \$1,000 principal amount of 2023 Notes (equivalent to an initial conversion price of approximately \$78.37 per share of Class C capital stock). The conversion rate is subject to customary adjustments upon the occurrence of certain events. The Company may redeem for cash all or part of the 2023 Notes, at its option, on or after July 6, 2021, under certain circumstances at a redemption price equal to 100% of the principal amount of the 2023 Notes to be redeemed, plus accrued and unpaid interest to, but excluding, the redemption date (as defined in the indenture governing the 2023 Notes). For additional information regarding the 2023 Notes, see Note 14 to our consolidated financial statements.

The following table presents selected cash flow data for the periods presented:

	<b>Year Ended December 31,</b>		
	<b>2018</b>	<b>2017</b>	<b>2016</b>
	<b>(in thousands)</b>		
<b>Cash Flow Data:</b>			
Net cash provided by operating activities	\$ 3,850	\$ 258,191	\$ 8,645
Net cash used in investing activities	(622,639)	(247,394)	(65,719)
Net cash provided by financing activities	930,137	97,706	71,528

### ***Cash Flows Provided By Operating Activities***

Our operating cash flows result primarily from cash received from real estate professionals, rental professionals, mortgage professionals and brand advertisers. Our primary uses of cash from operating activities include payments for marketing and advertising activities, homes purchased through Zillow Offers, mortgages funded through our mortgage originations business and employee compensation and benefits. Additionally, uses of cash from operating activities include costs associated with operating our mobile applications and websites and other general corporate expenditures.

For the year ended December 31, 2018, net cash provided by operating activities was \$3.9 million. This was primarily driven by a net loss of \$119.9 million, adjusted by share-based compensation expense of \$149.1 million, depreciation and amortization expense of \$99.4 million, non-cash impairment charges totaling \$79.0 million, amortization of contract cost assets of \$36.0 million, a non-cash change in our deferred income taxes of \$31.1 million, amortization of the discount and issuance costs on the 2023 Notes and 2021 Notes of \$26.7 million, accretion of bond discount of \$4.3 million, a loss on disposal of property and equipment of \$3.6 million and a change in deferred rent of \$2.0 million. Changes in operating assets and liabilities decreased cash provided by operating activities by \$233.5 million. The changes in operating assets and liabilities are primarily due to a \$162.8 million increase in inventory due to the purchase of homes through Zillow Offers, a \$41.5 million increase in

contract cost assets due primarily to the capitalization of sales commissions, a \$34.1 million increase in prepaid expenses and other assets driven primarily by the timing of payments, a \$12.6 million increase in accounts receivable due primarily to an increase in revenue and a \$11.3 million increase in accrued compensation and benefits driven primarily by the timing of payments.

For the year ended December 31, 2017, net cash provided by operating activities was \$258.2 million. This was primarily driven by a net loss of \$94.4 million, adjusted by a non-cash impairment charge of \$174.0 million, depreciation and amortization expense of \$110.2 million, share-based compensation expense of \$113.6 million, an \$89.6 million non-cash change in our net deferred tax asset and valuation allowance as a result of the non-cash impairment charge and the rate decrease included in the Tax Cuts and Jobs Act, amortization of the discount and issuance costs on the 2021 Notes of \$18.0 million, an increase in bad debt expense of \$7.3 million, a change in deferred rent of \$7.1 million and a loss on disposal of property and equipment of \$5.7 million. Changes in operating assets and liabilities increased cash provided by operating activities by \$5.9 million. The changes in operating assets and liabilities are primarily due to a \$21.2 million increase in accounts receivable driven by an increase in revenue, a \$19.0 million increase in accrued expenses and other current liabilities due to growth in our business, partially offset by a \$10.8 million decrease in prepaid expenses and other assets driven primarily by the timing of payments.

For the year ended December 31, 2016, net cash provided by operating activities was \$8.6 million. This was driven by a net loss of \$220.4 million, including the impact of the settlement of a lawsuit for \$130.0 million in June 2016, adjusted by share-based compensation expense of \$106.9 million, depreciation and amortization expense of \$100.6 million, a loss on debt extinguishment of \$22.8 million, a loss on disposal of property and equipment of \$3.7 million, an increase in bad debt expense of \$2.7 million, an increase in the balance of deferred rent of \$1.7 million, amortization of bond premium of \$1.5 million, a \$1.4 million gain on the divestiture of a business, a \$1.4 million non-cash change in the valuation allowance related to a deferred tax liability generated in connection with our February 2016 acquisition of Naked Apartments, and amortization of the discount and issuance costs on the 2021 Notes of \$0.9 million. Changes in operating assets and liabilities decreased cash provided by operating activities by \$8.9 million. The decrease in operating assets and liabilities is primarily due to a \$13.3 million decrease in accounts receivable driven by the timing of payments received, a \$13.3 million decrease in prepaid expenses and other assets driven by the timing of payments made, and a \$12.5 million increase in accrued compensation and benefits due primarily to an increase in sales commissions driven by increased sales as well as the timing of payroll.

### ***Cash Flows Used In Investing Activities***

Our primary investing activities include the purchase and sale or maturity of investments, the purchase of property and equipment and intangible assets, the purchase of equity investments, net cash paid in connection with acquisitions and proceeds from divestiture of businesses.

For the year ended December 31, 2018, net cash used in investing activities was \$622.6 million. This was primarily the result of \$489.0 million of net purchases of investments in connection with investment of a portion of the net proceeds from our July 2018 public offerings of Class C capital stock and 2023 Notes, \$78.5 million of purchases for property and equipment and intangible assets and \$55.1 million of net cash paid for acquisitions, related to the October 2018 acquisition of MLOA.

For the year ended December 31, 2017, net cash used in investing activities was \$247.4 million. This was primarily the result of \$147.8 million of net purchases of investments, \$78.6 million of purchases for property and equipment and intangible assets, \$11.5 million paid in connection with acquisitions, and approximately \$10.0 million related to the purchase of an equity investment, partially offset by \$0.6 million in proceeds from our August 2016 sale of our Diverse Solutions business.

For the year ended December 31, 2016, net cash used in investing activities was \$65.7 million. This was primarily the result of \$71.7 million of purchases for property and equipment and intangible assets, \$16.3 million paid in connection with our February 2016 acquisition of Naked Apartments and our August 2016 acquisition of Bridge Interactive, \$10.0 million related to the purchase of an equity investment, partially offset by \$29.1 million of net maturities and sales of investments and \$3.2 million in proceeds from the divestiture of a business.



The increases in capital expenditures and intangible assets during all three periods reflect our continued investments in support of business growth. We expect to continue to make significant investments in our business to provide for the continued innovation in our products and services in 2019 and thereafter.

#### ***Cash Flows Provided By Financing Activities***

For the year ended December 31, 2018, cash flows provided by financing activities includes \$364.0 million of net proceeds from the issuance of the 2023 Notes and \$360.3 million of net proceeds from our Class C capital stock public offering, partially offset by \$29.4 million of premiums paid for Capped Call Confirmations. It also includes \$120.1 million in proceeds from the exercise of option awards, \$116.7 million of proceeds from borrowing on the Revolving Credit Facility and \$0.5 million of proceeds from borrowing on the warehouse lines of credit associated with our October 2018 acquisition of MLOA, partially offset by \$2.0 million of contingent consideration related to prior period acquisitions.

For the year ended December 31, 2017, our financing activities primarily related to the exercise of employee option awards. The proceeds from the exercise of option awards for the year ended December 31, 2017 were \$98.1 million.

For the year ended December 31, 2016, the proceeds from the issuance of the 2021 Notes, net of issuance costs, were \$447.8 million. The Company also paid approximately \$36.6 million in premiums for certain Capped Call Confirmations in December 2016. The Company used approximately \$370.2 million of the net proceeds from the issuance of the 2021 Notes to repurchase \$219.9 million aggregate principal of the 2020 Notes in privately negotiated transactions. The proceeds from the exercise of option awards for the year ended December 31, 2016 were \$31.2 million.

#### **Off-Balance Sheet Arrangements**

We did not have any off-balance sheet arrangements other than outstanding surety bonds issued for our benefit of approximately \$8.9 million and \$3.7 million, respectively, as of December 31, 2018 and 2017. We do not believe that the surety bonds will have a material effect on our liquidity, capital resources, market risk support or credit risk support. For additional information regarding the surety bonds, see Note 19 to our consolidated financial statements under the subsection titled “Surety Bonds”.

**Contractual Obligations and Other Commitments**

The following table provides a summary of our contractual obligations as of December 31, 2018:

	Payment Due By Period				
	Total	Less Than 1 Year	1-3 Years	3-5 Years	More Than 5 Years
(in thousands, unaudited)					
2023 Notes (1)	\$ 373,750	\$ —	\$ —	\$ 373,750	\$ —
Interest on 2023 Notes (2)	25,228	5,606	11,213	8,409	—
2021 Notes (3)	460,000	—	460,000	—	—
Interest on 2021 Notes (4)	26,833	9,200	17,633	—	—
2020 Notes (5)	9,637	—	9,637	—	—
Interest on 2020 Notes (6)	530	265	265	—	—
Homes under contract (7)	88,943	88,943	—	—	—
Revolving credit facility (8)	116,700	116,700	—	—	—
Warehouse lines of credit (9)	33,018	33,018	—	—	—
Operating lease obligations (10)	266,885	29,085	78,159	74,179	85,462
Purchase obligations (11)	160,866	64,124	96,742	—	—
Total contractual obligations	<u>\$ 1,562,390</u>	<u>\$ 346,941</u>	<u>\$ 673,649</u>	<u>\$ 456,338</u>	<u>\$ 85,462</u>

- (1) The aggregate principal amount of the 2023 Notes is due on July 1, 2023 if not earlier converted or redeemed.
- (2) The stated interest rate on the 2023 Notes is 1.50%.
- (3) The aggregate principal amount of the 2021 Notes is due on December 1, 2021 if not earlier converted or redeemed.
- (4) The stated interest rate on the 2021 Notes is 2.00%.
- (5) The aggregate principal amount of the 2020 Notes is due on December 15, 2020 if not earlier converted or redeemed.
- (6) The stated interest rate on the 2020 Notes is 2.75%.
- (7) We have obligations to purchase homes under contract through our Zillow Offers business.
- (8) Includes principal amounts due for amounts borrowed under the Revolving Credit Facility entered into on July 31, 2018. Amount excludes estimated interest payments.
- (9) Includes principal amounts due for amounts borrowed under the warehouse lines of credit assumed in connection with the October 2018 acquisition of MLOA. Amount excludes estimated interest payments.
- (10) Our operating lease obligations consist of various operating leases for office space under noncancelable operating lease agreements. For additional information regarding our operating leases, see Note 19 to our consolidated financial statements.
- (11) We have noncancelable purchase obligations for content related to our mobile applications and websites. For additional information regarding our purchase obligations, see Note 19 to our consolidated financial statements.

We have excluded unrecognized tax benefits from the contractual obligations table above because we cannot make a reasonably reliable estimate of the amount and period of payment due primarily to our significant net operating loss carryforwards.

In the course of business, we are required to provide financial commitments in the form of surety bonds to third parties as a guarantee of our performance on and our compliance with certain obligations. If we were to fail to perform or comply with these obligations, any draws upon surety bonds issued on our behalf would then trigger our payment obligation to the surety bond issuer. We have outstanding surety bonds issued for our benefit of approximately \$8.9 million and \$3.7 million, respectively, as of December 31, 2018 and 2017.

## Critical Accounting Policies and Estimates

Our consolidated financial statements are prepared in accordance with GAAP. The preparation of these consolidated financial statements requires us to make estimates and assumptions that affect the reported amounts of assets, liabilities, revenue, expenses and related disclosures. We evaluate our estimates and assumptions on an ongoing basis. Our estimates are based on historical experience and various other assumptions that we believe to be reasonable under the circumstances. Our actual results could differ from these estimates.

We believe that the assumptions and estimates associated with revenue recognition, the net realizable value of inventory, amortization period and recoverability of contract cost assets, website and software development costs, recoverability of long-lived assets and intangible assets with definite lives, share-based compensation, income taxes, and the recoverability of goodwill and indefinite-lived intangible assets, have the greatest potential impact on our consolidated financial statements. Therefore, we consider these to be our critical accounting policies and estimates.

### *Revenue Recognition*

We recognize revenue when (or as) we satisfy our performance obligations by transferring control of the promised products or services to our customers in an amount that reflects the consideration to which we expect to be entitled in exchange for those products or services.

As a practical expedient, we do not adjust the promised amount of consideration for the effects of a significant financing component as the period between our transfer of a promised product or service to a customer and when the customer pays for that product or service is one year or less.

We do not disclose the transaction price related to remaining performance obligations for (i) contracts with an original expected duration of one year or less and (ii) contracts for which we recognize revenue at the amount to which we have the right to invoice for performance completed to date.

In our IMT segment, we generate revenue from the sale of advertising services and our suite of marketing software and technology solutions to businesses and professionals primarily associated with the residential real estate, rental and mortgage industries. These professionals include real estate, rental and mortgage professionals and brand advertisers. Our four primary revenue categories within our IMT segment are Premier Agent, Rentals, Mortgages and Other.

In our Homes segment, we generate revenue from the resale of homes on the open market through our Zillow Offers program.

**Premier Agent Revenue.** Premier Agent revenue is derived from our Premier Agent and Premier Broker programs. Our Premier Agent and Premier Broker programs offer a suite of marketing and business technology products and services to help real estate agents and brokers achieve their advertising goals, while growing and managing their businesses and brands. All Premier Agents and Premier Brokers receive access to a dashboard portal on our mobile application or website that provides individualized program performance analytics, our customer relationship management, or CRM, tool that captures detailed information about each contact made with a Premier Agent or Premier Broker through our mobile and web platforms and our account management tools. We have concluded that the marketing and business technology products and services promised to Premier Agents and Premier Brokers represent distinct performance obligations.

We primarily offer our Premier Agent and Premier Broker advertising products on a cost per impression basis. Impressions are delivered when a sold advertisement appears on pages viewed by users of our mobile applications and websites. We determine the cost per impression delivered in each zip code using an auction-based pricing method in consideration of the total amount spent by Premier Agents and Premier Brokers to purchase impressions in the zip code during the month. A Premier Agent's or Premier Broker's share of voice in a zip code is determined by their proportional monthly budgeted spend in that zip code as a percentage of the total monthly budgeted spend of all Premier Agents and Premier Brokers in that zip code. The cost per impression that we charge is dynamic - as demand for impressions in a zip code increases or

decreases, the cost per impression in that zip code may be increased or decreased accordingly. The price paid for each impression is representative of the price at which we would sell an impression separately to a customer, or the stand-alone selling price.

We have not allocated the transaction price to each performance obligation as the amounts recognized would be the same irrespective of any allocation. As such, we recognize revenue related to the Premier Agent and Premier Broker products and services based on the contractual spend recognized on a straight-line basis during the contractual period over which the products and services are provided.

In April 2018, we began testing a new form of lead validation and distribution related to our auction-based pricing model whereby the share of voice purchased by Premier Agents and Premier Brokers will represent both the share of impressions delivered as advertisements appearing on pages viewed by users of our mobile applications and websites, as well as the proportion of validated consumer connections a Premier Agent or Premier Broker receives. When consumers who are interested in connecting with a real estate professional do not select a specific Premier Agent or Premier Broker advertisement on one of Zillow Group's mobile applications or websites, the validated consumer leads will be distributed to Premier Agents and Premier Brokers in proportion to their share of voice. We believe distributing validated consumer connection leads on the basis of share of voice creates better experiences for consumers and further strengthens our partnerships with real estate professionals. We substantially completed the nationwide adoption of this new lead distribution model in the fourth quarter of 2018. We are unable to predict whether this change will have a material impact on revenue or other results of operations.

In October 2018, we began testing a new Flex Pricing model for Premier Broker and Premier Agent advertising services in limited markets. With the Flex Pricing model, Premier Brokers and Premier Agents are provided with validated leads at no upfront cost, and they pay a performance advertising fee only when a real estate transaction is closed with one of their leads. With this pricing model, the transaction price represents variable consideration as the amount to which we expect to be entitled varies based on the number of validated leads that convert into real estate transactions. As the amount of consideration is dependent upon factors outside our influence and our experience with this pricing model is limited, we fully constrain the estimated variable consideration. When a real estate transaction is closed with a Flex Pricing lead and payment is made, the uncertainty is resolved and revenue is recognized in the period for the satisfied performance obligations.

**Rentals Revenue.** Rentals revenue includes our rentals marketplace and suite of tools for rental professionals. Rentals revenue primarily includes revenue generated by advertising sold to property managers and other rental professionals on a cost per lead, cost per click or cost per lease generated basis. We recognize revenue as leads or clicks are provided to rental professionals, which is the amount for which we have the right to invoice. The number of leases generated through our rentals marketplace during the period is accounted for as variable consideration, and we estimate these amounts based on the expected number of qualified leases secured during the period. We do not believe that a significant reversal in the amount of cumulative revenue recognized will occur once the uncertainty related to the number of leases secured is subsequently resolved.

Beginning in 2018, rentals revenue also includes revenue generated from Zillow's rental applications product. We recognize revenue for the rental applications product on a straight-line basis during the contractual period over which the customer has the right to access and submit a rental application.

**Mortgages Revenue.** Mortgages revenue primarily includes marketing products sold to mortgage professionals on a cost per lead basis, including our Custom Quote and a portion of our Connect services, and on a subscription basis, including a portion of our Connect service. For our Connect and Custom Quote cost per lead mortgage marketing products, participating qualified mortgage professionals typically make a prepayment to gain access to consumers interested in connecting with mortgage professionals. Mortgage professionals who exhaust their initial prepayment prepay additional funds to continue to participate in the marketplace. For our Connect subscription mortgage marketing product, participating qualified mortgage professionals generally prepay a monthly subscription fee, which they then allocate to desired geographic counties. In Zillow Group's Connect platform, consumers answer a series of questions to find a local lender, and mortgage professionals receive consumer contact information, or leads, when the consumer chooses to share their information with a lender. Consumers who request rates for mortgage loans in Custom Quotes are presented with customized quotes from participating mortgage professionals.

For our cost per lead mortgages products, we recognize revenue when a user contacts a mortgage professional through Zillow Group's mortgages platform, which is the amount for which we have the right to invoice. For our Connect subscription product, the opportunity to receive a consumer contact is based on the mortgage professional's relative share of voice in a geographic county. When a consumer submits a contact, Zillow Group contacts a group of subscription mortgage professionals via text message, and the first mortgage professional to respond receives the consumer contact information. We recognize revenue based on the contractual spend recognized on a straight-line basis during the contractual period over which the service is provided. This methodology best depicts how we satisfy our performance obligation to subscription customers, as we continuously transfer control of the performance obligation to the customer throughout the contractual period.

Beginning in the fourth quarter of 2018, mortgages revenue also includes revenue generated by our mortgage originations business. Revenue from loan originations is recognized at the time the related real estate transactions are completed, usually upon the close of escrow and when we fund mortgage loans. These loans are then held for sale. Mortgage loans held for sale are initially recorded at fair value based on either sale commitments or current market quotes and are adjusted for subsequent changes in fair value until the loan is sold. Net origination costs and fees associated with mortgage loans are recognized as incurred at the time of origination. We sell substantially all of the mortgages we originate and the related servicing rights to third-party purchasers.

Mortgages revenue also includes revenue generated by Mortech, which provides subscription-based mortgage software solutions, including a product and pricing engine and lead management platform, for which we recognize revenue on a straight-line basis during the contractual period over which the services are provided.

**Other Revenue.** Other revenue primarily includes revenue generated by new construction and display, as well as revenue from the sale of various other marketing and business products and services to real estate professionals. Our new construction marketing solutions allow home builders to showcase their available inventory to home shoppers. New construction revenue primarily includes revenue generated by advertising sold to builders on a cost per residential community basis, and revenue is recognized on a straight-line basis during the contractual period over which the communities are advertised on our mobile applications and websites. Display revenue primarily consists of graphical mobile and web advertising sold on a cost per thousand impressions or cost per click basis to advertisers promoting their brands on our mobile applications and websites. We recognize display revenue as clicks occur or as impressions are delivered to users interacting with our mobile applications or websites, which is the amount for which we have the right to invoice.

**Homes Revenue.** Homes revenue is derived from the resale of homes on the open market through our Zillow Offers program. Homes revenue is recognized at the time of the closing of the home sale when title to and possession of the property are transferred to the buyer.

### ***Inventory***

Inventory is comprised of homes acquired through our Zillow Offers program and is stated at the lower of cost or net realizable value. Homes are removed from inventory on a specific identification basis when they are resold. Stated cost includes consideration paid to acquire and update each home including associated allocated overhead costs. Work-in-progress inventory includes homes undergoing updates and finished goods inventory includes homes ready for resale. Unallocated overhead costs are expensed as incurred and included in cost of revenue. Selling costs, including commissions, escrow and title fees, staging, and holding costs, including utilities, taxes and maintenance, are expensed as incurred and included in sales and marketing expenses.

Each quarter we review the value of homes held in inventory for indicators that net realizable value is lower than cost. When evidence exists that the net realizable value of inventory is lower than its cost, the difference is recognized in cost of revenue.

### ***Contract Cost Assets***

We capitalize certain incremental costs of obtaining contracts with customers that we expect to recover. These costs relate to commissions paid to sales personnel, primarily for our Premier Agent and Premier Broker programs. As a practical

expedient, we recognize the incremental costs of obtaining a contract as an expense when incurred if the amortization period of the asset that we otherwise would have recognized is one year or less. Capitalized commission costs are recorded as contract cost assets in our consolidated balance sheets. Contract cost assets are amortized to expense on a straight-line basis over a period that is consistent with the transfer to the customer of the products or services to which the asset relates, generally the estimated life of the customer relationship. Amortization expense related to contract cost assets is included in sales and marketing expenses in our consolidated statements of operations. Our determination of the estimated life of the customer relationship involves significant judgment. In determining the estimated life of our customer relationships, we consider quantitative and qualitative data, including, but not limited to, historical customer data, recent changes or expected changes in product or service offerings, and changes in how we monetize our products and services. The amortization period for our Premier Agent and Premier Broker programs ranges from two to three years.

### ***Website and Software Development Costs***

The costs incurred in the preliminary stages of development are expensed as incurred. Once an application has reached the development stage, internal and external costs, if direct and incremental and deemed by management to be significant, are capitalized in property and equipment and amortized on a straight-line basis over their estimated useful lives. Maintenance and enhancement costs, including those costs in the post-implementation stages, are typically expensed as incurred, unless such costs relate to substantial upgrades and enhancements to the website or software that result in added functionality, in which case the costs are capitalized and amortized on a straight-line basis over the estimated useful lives. Amortization expense related to capitalized website and software development costs is included in technology and development expense.

Capitalized development activities placed in service are amortized over the expected useful lives of those releases, currently estimated at one to three years. The estimated useful lives of website and software development activities are reviewed frequently and adjusted as appropriate to reflect upcoming development activities that may include significant upgrades and/or enhancements to the existing functionality.

We exercise judgment in determining the point at which various projects may be capitalized, in assessing the ongoing value of the capitalized costs, and in determining the estimated useful lives over which the costs are amortized. To the extent that we change the manner in which we develop and test new features and functionalities related to our mobile applications and websites, assess the ongoing value of capitalized assets, or determine the estimated useful lives over which the costs are amortized, the amount of website and software development costs we capitalize and amortize could change in future periods.

### ***Recoverability of Intangible Assets with Definite Lives and Other Long-Lived Assets***

We evaluate intangible assets and other long-lived assets for impairment whenever events or circumstances indicate that they may not be recoverable. Recoverability is measured by comparing the carrying amount of an asset group to future undiscounted net cash flows expected to be generated. We group assets for purposes of such review at the lowest level for which identifiable cash flows of the asset group are largely independent of the cash flows of the other groups of assets and liabilities. If this comparison indicates impairment, the amount of impairment to be recognized is calculated as the difference between the carrying value and the fair value of the asset group.

Unforeseen events, changes in circumstances and market conditions and material differences in estimates of future cash flows could adversely affect the fair value of our assets and could result in an impairment charge. Fair value can be estimated utilizing a number of techniques including quoted market prices, prices for comparable assets, or other valuation processes involving estimates of cash flows, multiples of earnings or revenues, and we may make various assumptions and estimates when performing our impairment assessments, particularly as it relates to cash flow projections. Cash flow estimates are by their nature subjective and include assumptions regarding factors such as recent and forecasted operating performance, revenue trends and operating margins. These estimates could also be adversely impacted by changes in federal, state, or local regulations, economic downturns or developments, or other market conditions affecting our industry.



### ***Share-Based Compensation***

We measure compensation expense for all share-based awards at fair value on the date of grant and recognize compensation expense over the service period for awards expected to vest. We use the Black-Scholes-Merton option-pricing model to determine the fair value for option awards and recognize compensation expense on a straight-line basis over the option awards' vesting period. For restricted stock units and restricted units, we use the market value of our Class A common stock and Class C capital stock, as applicable, on the date of grant to determine the fair value of the award, and we recognize compensation expense on a straight-line basis over the awards' vesting period.

Determining the fair value of option awards at the grant date requires judgment. If any of the assumptions used in the Black-Scholes-Merton model changes significantly, share-based compensation expense for future option awards may differ materially compared with the awards granted previously. In valuing our option awards, we make assumptions about risk-free interest rates, dividend yields, volatility, and weighted-average expected lives. In addition, through December 31, 2016 we made assumptions about estimated forfeiture rates. Beginning on January 1, 2017, we elected to account for forfeitures as they occur.

***Risk-free interest rate.*** Risk-free interest rates are derived from U.S. Treasury securities as of the option award's grant date.

***Expected dividend yields.*** Expected dividend yields are based on our historical dividend payments, which have been zero to date.

***Volatility.*** The expected volatility for our Class A common stock and Class C capital stock is estimated using our historical volatility.

***Expected term.*** The weighted-average expected life of the option awards is estimated based on our historical exercise data.

***Forfeiture rate.*** Prior to January 1, 2017, forfeiture rates were estimated using historical actual forfeiture trends as well as our judgment of future forfeitures. These rates were evaluated at least quarterly and any change in share-based compensation expense was recognized in the period of the change. We considered many factors when estimating expected forfeitures, including employee class and historical experience.

We will continue to use judgment in evaluating the expected volatility and expected terms utilized for our share-based compensation expense calculations on a prospective basis. Actual results, and future changes in estimates, may differ substantially from management's current estimates. As we continue to accumulate additional data related to our Class A common stock and Class C capital stock, we may have refinements to the estimates of our expected volatility and expected terms, which could materially impact our future share-based compensation expense. In future periods, we expect our share-based compensation expense to increase as a result of our existing, unrecognized share-based compensation that will be recognized as the awards vest, and as we grant additional share-based awards to attract and retain employees.

### ***Income Taxes***

We use the asset and liability approach for accounting and reporting income taxes, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of temporary differences between the financial statement and tax bases of assets and liabilities at the applicable enacted tax rates. A valuation allowance against deferred tax assets would be established if, based on the weight of available evidence, it is more likely than not (a likelihood of more than 50%) that some or all of the deferred tax assets are not expected to be realized.

Our assumptions, judgments, and estimates relative to the value of our deferred tax assets take into account predictions of the amount and category of future taxable income, such as income from operations or capital gains income. Actual operating results and the underlying amount and category of income in future years could render our current assumptions, judgments, and estimates of recoverable net deferred taxes inaccurate. Any of the assumptions, judgments, and estimates mentioned above

could cause our actual income tax obligations to differ from our estimates, thus materially impacting our financial position and results of operations.

Since inception, we have typically incurred annual operating losses, and accordingly, we have generally not recorded a material current provision for income taxes, though we have historically in certain instances recorded income tax benefits in connection with acquisitions. However, as part of the Tax Act, net operating losses generated after December 31, 2017 create a tax benefit because they can be offset against our indefinite lived deferred tax liabilities and release that related portion of our valuation allowance.

We establish reserves for tax-related uncertainties based on estimates of whether, and the extent to which, additional taxes will be due. We adjust these reserves in light of changing facts and circumstances, such as the closing of a tax audit, new tax legislation or the change of an estimate. To the extent that the final tax outcome of these matters is different than the amounts recorded, such differences will affect the provision for income taxes in the period in which such determination is made.

### ***Recoverability of Goodwill and Indefinite-Lived Intangible Assets***

Goodwill represents the excess of the cost of an acquired business over the fair value of the assets acquired at the date of acquisition, and is not amortized. We assess the impairment of goodwill on an annual basis, in our fourth quarter, or whenever events or changes in circumstances indicate that goodwill may be impaired. Typically, we choose to forgo the initial qualitative assessment and perform a quantitative analysis to assist in our annual evaluation. If impairment exists, the carrying value of the goodwill is reduced to fair value through an impairment charge recorded in our statements of operations.

Our indefinite-lived intangible asset is not amortized, and we assess the asset for impairment on an annual basis, in our fourth quarter, or whenever events or changes in circumstances indicate that the asset may be impaired. On an interim basis, we consider if there are any events and circumstances that could affect the significant inputs used to determine the fair value of the indefinite-lived intangible asset, including, but not limited to, costs that could have a negative effect on future expected earnings and cash flows, changes in certain key performance metrics, and changes in management, key personnel, strategy or customers. In our evaluation of our trade names and trademarks indefinite-lived intangible asset, we typically first perform a qualitative assessment to determine whether the fair value of the indefinite-lived intangible asset is more likely than not impaired. If so, we perform a quantitative assessment and an impairment charge is recorded in our statements of operations for the excess of the carrying value of the indefinite-lived intangible assets over their fair value.

During the year ended December 31, 2018, we recognized a non-cash impairment charge of \$69.0 million related to our indefinite-lived Trulia trade names and trademarks intangible asset. The impairment charge is included in Impairment costs within our IMT segment. In connection with our annual budgeting process that was substantially completed during the three months ended December 31, 2018, we identified factors that led us to conclude it was more likely than not that the \$177.0 million carrying value of the asset exceeded its fair value. The most significant of such factors was a shortfall in projected revenue related to the Trulia brand compared to projections at the time the intangible asset was remeasured as of October 1, 2017. Accordingly, with the assistance of a third-party valuation specialist, we performed a quantitative analysis to determine the fair value of the intangible asset and concluded that our best estimate of its fair value was \$108.0 million. The valuation was prepared using an income approach based on the relief-from-royalty method and relied on inputs with unobservable market prices including the assumed revenue growth rates, royalty rate, discount rate, and estimated tax rate, and therefore is considered a Level 3 measurement under the fair value hierarchy. In connection with this impairment analysis, we evaluated our planned future use of the Trulia trade names and trademarks intangible asset and concluded that it remains appropriate to consider this asset to have an indefinite life.

To the extent there is a shortfall in actual revenue attributable to the Trulia brand as compared to our estimated projections as of December 2018, the date of our interim impairment test, additional impairment could be recorded in future periods.

### ***Recently Adopted Accounting Standards and Recently Issued Accounting Standards Not Yet Adopted***

For information about our recently adopted accounting standards and recently issued accounting standards not yet adopted, see Note 2 of the accompanying notes to our consolidated financial statements included within this annual report.

**Item 7A. Quantitative and Qualitative Disclosures About Market Risk.**

We are exposed to market risks in the ordinary course of our business. These risks primarily consist of fluctuations in interest rates.

***Interest Rate Risk***

Under our current investment policy, we invest our excess cash in money market funds, certificates of deposit, U.S. government agency securities, commercial paper, foreign government securities, municipal securities, and corporate notes and bonds. Our current investment policy seeks first to preserve principal, second to provide liquidity for our operating and capital needs and third to maximize yield without putting our principal at risk.

Our investments are exposed to market risk due to the fluctuation of prevailing interest rates that may reduce the yield on our investments or their fair value. As our investment portfolio is short-term in nature, we do not believe an immediate 10% increase in interest rates would have a material effect on the fair market value of our portfolio.

As of December 31, 2018, we have outstanding \$373.8 million aggregate principal Convertible Senior Notes due in 2023 (the “2023 Notes”), \$460.0 million aggregate principal Convertible Senior Notes due in 2021 (the “2021 Notes”) and \$9.6 million aggregate principal Convertible Senior Notes due in 2020 (the “2020 Notes”). The 2023 Notes were issued in July 2018 and carry a fixed interest rate of 1.50% per year. The 2021 Notes were issued in December 2016 and carry a fixed interest rate of 2.00% per year. The 2020 Notes were guaranteed by Zillow Group in connection with our February 2015 acquisition of Trulia, Inc. and carry a fixed interest rate of 2.75% per year.

Since the 2023 Notes, 2021 Notes, and 2020 Notes bear interest at fixed rates, the notes do not create direct financial statement risk associated with changes in interest rates as of December 31, 2018. However, the fair values of the 2023 Notes, 2021 Notes, and 2020 Notes change primarily when the market price of our stock fluctuates or interest rates change.

We are subject to market risk by way of changes in interest rates on borrowings under our revolving credit agreement with Credit Suisse AG, Cayman Islands Branch, which we entered into on July 31, 2018 (the “Revolving Credit Facility”). As of December 31, 2018, we have outstanding \$116.7 million of borrowings on the Revolving Credit Facility. Borrowings on our Revolving Credit Facility bear interest at a floating rate based on the one-month London Interbank Offered Rate (“LIBOR”) plus the applicable margin, as defined in the credit agreement governing the Revolving Credit Facility. Accordingly, fluctuations in market interest rates may increase or decrease our interest expense. Assuming no change in the outstanding borrowings on the Revolving Credit Facility, we estimate that a 1.0% increase in LIBOR would increase our annual interest expense by approximately \$1.2 million.

The October 31, 2018 acquisition of Mortgage Lenders of America, L.L.C. (“MLOA”) is expected to have a significant future impact on our exposure to interest rate risk. We are exposed to interest rate risk associated with our mortgage loan origination services which we manage through the use of forward sales of mortgage-backed securities. Additionally, as part of the acquisition of MLOA, Zillow Group acquired two warehouse lines of credit. Each line of credit provides for a current and maximum borrowing capacity of \$50.0 million, or \$100.0 million in total. The lines of credit mature on March 31, 2019 and July 15, 2019. Borrowings on the lines of credit bear interest at either the one-month LIBOR rate plus an applicable margin, as defined in the credit agreement governing the warehouse line of credit, or the daily adjusting LIBOR rate plus an applicable margin as defined in the credit agreement governing the warehouse line of credit. Assuming no change in the outstanding borrowings on the warehouse lines of credit, we estimate that a 1.0% increase in LIBOR would increase our annual interest expense associated with the lines of credit by approximately \$0.33 million.

***Inflation Risk***

We do not believe that inflation has had a material effect on our business, results of operations or financial condition. If our costs were to become subject to significant inflationary pressures, we may not be able to fully offset such higher costs through price increases. Our inability or failure to do so could harm our business, results of operations and financial condition.

***Foreign Currency Exchange Risk***

We do not believe that foreign currency exchange risk has had a material effect on our business, results of operations or financial condition. As we do not maintain a significant balance of foreign currency, we do not believe an immediate 10% increase or decrease in foreign currency exchange rates relative to the U.S. dollar would have a material effect on our business, results of operations or financial condition.

**Item 8. Financial Statements and Supplementary Data.****Index to Consolidated Financial Statements**

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The supplementary financial information required by this Item 8 is included in Item 7 under the caption "Quarterly Results of Operations."

**REPORT OF DELOITTE & TOUCHE LLP, INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM**

The Board of Directors and Shareholders of Zillow Group, Inc.

**Opinion on the Financial Statements**

We have audited the accompanying consolidated balance sheets of Zillow Group, Inc. (the “Company”) as of December 31, 2018 and 2017, and the related consolidated statements of operations, comprehensive loss, shareholders’ equity, and cash flows for each of the two years in the period ended December 31, 2018 and the related notes (collectively referred to as the “financial statements”). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the two years ended December 31, 2018, in conformity with accounting principles generally accepted in the United States of America.

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company’s internal control over financial reporting as of December 31, 2018, based on the criteria established in Internal Control - Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission and our report dated February 21, 2019 expressed an unqualified opinion on the Company’s internal control over financial reporting.

**Change in Accounting Principle**

As discussed in Note 2 to the financial statements, the Company changed its method of accounting for costs to obtain customer contracts during the year ended December 31, 2018 due to the adoption of the new revenue standard. The Company adopted the new revenue standard using the modified retrospective approach.

**Basis for Opinion**

These financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on these financial statements based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities law and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audit included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audit also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audit provides a reasonable basis for our opinion.

/s/ DELOITTE & TOUCHE LLP

Seattle, Washington  
February 21, 2019

We have served as the Company’s auditor since 2016.



**REPORT OF ERNST & YOUNG LLP, INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM**

The Board of Directors and Shareholders of Zillow Group, Inc.

We have audited the accompanying consolidated statements of operations, comprehensive loss, shareholders' equity and cash flows of Zillow Group, Inc. for the year ended December 31, 2016. These consolidated financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these consolidated financial statements based on our audit.

We conducted our audit in accordance with the standards of the Public Company Accounting Oversight Board (United States). Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the consolidated results of operations and cash flows of Zillow Group, Inc. for the year ended December 31, 2016, in conformity with U.S. generally accepted accounting principles.

/s/ ERNST & YOUNG LLP

Seattle, Washington  
February 7, 2017

**ZILLOW GROUP, INC.**  
**CONSOLIDATED BALANCE SHEETS**  
(in thousands, except share data)

	<b>December 31,</b>	
	<b>2018</b>	<b>2017</b>
<b>Assets</b>		
Current assets:		
Cash and cash equivalents	\$ 651,058	\$ 352,095
Short-term investments	903,867	410,444
Accounts receivable, net of allowance for doubtful accounts of \$4,838 and \$5,341 at December 31, 2018 and 2017, respectively	66,083	54,396
Inventory	162,829	—
Mortgage loans held for sale	35,409	—
Prepaid expenses and other current assets	61,067	24,590
Restricted cash	12,385	—
Total current assets	1,892,698	841,525
Contract cost assets	45,819	—
Property and equipment, net	135,172	112,271
Goodwill	1,984,907	1,931,076
Intangible assets, net	215,904	319,711
Other assets	16,616	25,934
Total assets	\$ 4,291,116	\$ 3,230,517
<b>Liabilities and shareholders' equity</b>		
Current liabilities:		
Accounts payable	\$ 7,471	\$ 3,587
Accrued expenses and other current liabilities	63,101	61,373
Accrued compensation and benefits	31,388	19,109
Revolving credit facility	116,700	—
Warehouse lines of credit	33,018	—
Deferred revenue	34,080	31,918
Deferred rent, current portion	1,740	2,400
Total current liabilities	287,498	118,387
Deferred rent, net of current portion	19,945	21,330
Long-term debt	699,020	385,416
Deferred tax liabilities and other long-term liabilities	17,474	44,561
Total liabilities	1,023,937	569,694
Commitments and contingencies (Note 19)		
Shareholders' equity:		
Preferred stock, \$0.0001 par value; 30,000,000 shares authorized; no shares issued and outstanding	—	—
Class A common stock, \$0.0001 par value; 1,245,000,000 shares authorized; 58,051,448 and 56,629,103 shares issued and outstanding as of December 31, 2018 and 2017, respectively	6	6
Class B common stock, \$0.0001 par value; 15,000,000 shares authorized; 6,217,447 shares issued and outstanding as of December 31, 2018 and 2017	1	1
Class C capital stock, \$0.0001 par value; 600,000,000 shares authorized; 139,635,370 and 127,268,598 shares issued and outstanding as of December 31, 2018 and 2017, respectively	14	13
Additional paid-in capital	3,939,842	3,254,146
Accumulated other comprehensive loss	(905)	(1,100)
Accumulated deficit	(671,779)	(592,243)
Total shareholders' equity	3,267,179	2,660,823
Total liabilities and shareholders' equity	\$ 4,291,116	\$ 3,230,517

See accompanying notes to consolidated financial statements.

**ZILLOW GROUP, INC.**  
**CONSOLIDATED STATEMENTS OF OPERATIONS**  
(in thousands, except per share data)

	<b>Year Ended December 31,</b>		
	<b>2018</b>	<b>2017</b>	<b>2016</b>
Revenue:			
IMT	\$ 1,281,189	\$ 1,076,794	\$ 846,589
Homes	52,365	—	—
Total revenue	1,333,554	1,076,794	846,589
Cost of revenue (exclusive of amortization) (1):			
IMT	104,330	85,203	69,262
Homes	49,260	—	—
Total cost of revenue	153,590	85,203	69,262
Sales and marketing	552,621	448,201	382,419
Technology and development	410,818	319,985	255,583
General and administrative	262,153	210,816	332,007
Impairment costs	79,000	174,000	—
Acquisition-related costs	2,332	463	1,423
Integration costs	2,015	—	—
Gain on divestiture of business	—	—	(1,251)
Total costs and expenses	1,462,529	1,238,668	1,039,443
Loss from operations	(128,975)	(161,874)	(192,854)
Loss on debt extinguishment	—	—	(22,757)
Other income	19,270	5,385	2,711
Interest expense	(41,255)	(27,517)	(7,408)
Loss before income taxes	(150,960)	(184,006)	(220,308)
Income tax benefit (expense)	31,102	89,586	(130)
Net loss	\$ (119,858)	\$ (94,420)	\$ (220,438)
Net loss per share — basic and diluted	\$ (0.61)	\$ (0.51)	\$ (1.22)
Weighted-average shares outstanding — basic and diluted	197,944	186,453	180,149
(1) Amortization of website development costs and intangible assets included in technology and development	\$ 79,309	\$ 94,349	\$ 87,060

See accompanying notes to consolidated financial statements.

**ZILLOW GROUP, INC.**  
**CONSOLIDATED STATEMENTS OF COMPREHENSIVE LOSS**  
(in thousands)

	<b>Year Ended December 31,</b>		
	<b>2018</b>	<b>2017</b>	<b>2016</b>
Net loss	\$ (119,858)	\$ (94,420)	\$ (220,438)
Other comprehensive income (loss):			
Unrealized gains (losses) on investments	144	(858)	229
Currency translation adjustments	51	—	—
Total other comprehensive income (loss)	195	(858)	229
Comprehensive loss	<u>\$ (119,663)</u>	<u>\$ (95,278)</u>	<u>\$ (220,209)</u>

See accompanying notes to consolidated financial statements.

**ZILLOW GROUP, INC.**  
**CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY**  
(in thousands, except share data)

	Class A Common Stock, Class B Common Stock and Class C Capital Stock		Additional Paid-In Capital	Accumulated Deficit	Accumulated Other Comprehensive Loss	Total Shareholders' Equity
	Shares	Amount				
Balance at December 31, 2015	178,474,917	\$ 18	\$ 2,956,111	\$ (276,605)	\$ (471)	\$ 2,679,053
Issuance of common and capital stock upon exercise of stock options	2,518,172	—	31,211	—	—	31,211
Vesting of restricted stock units	1,487,263	—	—	—	—	—
Shares and value of restricted stock units withheld for tax liability	(21,634)	—	(616)	—	—	(616)
Share-based compensation expense	—	—	116,979	—	—	116,979
Portion of repurchase price recorded in additional paid-in capital in connection with partial repurchase of 2020	—	—	(127,615)	—	—	(127,615)
Equity component of issuance of 2021 Notes, net of issuance costs of \$2,494	—	—	91,400	—	—	91,400
Premiums paid for Capped Call Confirmations	—	—	(36,616)	—	—	(36,616)
Net loss	—	—	—	(220,438)	—	(220,438)
Other comprehensive income	—	—	—	—	229	229
Balance at December 31, 2016	182,458,718	18	3,030,854	(497,043)	(242)	2,533,587
Cumulative-effect adjustment from adoption of guidance on accounting for share-based payment transactions	—	—	780	(780)	—	—
Issuance of common and capital stock upon exercise of stock options	6,202,421	2	98,070	—	—	98,072
Vesting of restricted stock units	1,463,825	—	—	—	—	—
Shares and value of restricted stock units withheld for tax liability	(9,816)	—	(365)	—	—	(365)
Share-based compensation expense	—	—	124,807	—	—	124,807
Net loss	—	—	—	(94,420)	—	(94,420)
Other comprehensive loss	—	—	—	—	(858)	(858)
Balance at December 31, 2017	190,115,148	20	3,254,146	(592,243)	(1,100)	2,660,823
Cumulative-effect adjustment from adoption of guidance on revenue from contracts with customers	—	—	—	40,322	—	40,322
Issuance of common and capital stock upon exercise of stock options	5,472,728	—	120,074	—	—	120,074
Vesting of restricted stock units	1,740,134	—	—	—	—	—
Shares and value of restricted stock units withheld for tax liability	(1,489)	—	(70)	—	—	(70)
Share-based compensation expense	—	—	157,674	—	—	157,674
Portion of conversion recorded in additional paid-in-capital in connection with partial conversion of 2020 Notes	20,727	—	500	—	—	500
Issuance of Class C capital stock in connection with equity offering, net of issuance costs of \$13,425	6,557,017	1	360,345	—	—	360,346
Premiums paid for Capped Call Confirmations	—	—	(29,414)	—	—	(29,414)
Equity component of issuance of 2023 Notes, net of issuance costs of \$2,047	—	—	76,587	—	—	76,587
Net loss	—	—	—	(119,858)	—	(119,858)
Other comprehensive income	—	—	—	—	195	195
Balance at December 31, 2018	203,904,265	\$ 21	\$ 3,939,842	\$ (671,779)	\$ (905)	\$ 3,267,179

See accompanying notes to consolidated financial statements.

**ZILLOW GROUP, INC.**  
**CONSOLIDATED STATEMENTS OF CASH FLOWS**  
(in thousands)

	Year Ended December 31,		
	2018	2017	2016
<b>Operating activities</b>			
Net loss	\$ (119,858)	\$ (94,420)	\$ (220,438)
Adjustments to reconcile net loss to net cash provided by operating activities:			
Depreciation and amortization	99,391	110,155	100,590
Share-based compensation expense	149,084	113,571	106,918
Amortization of contract cost assets	36,013	—	—
Loss on debt extinguishment	—	—	22,757
Amortization of discount and issuance costs on 2023 and 2021 Notes	26,672	18,012	883
Impairment costs	79,000	174,000	—
Deferred income taxes	(31,102)	(89,586)	(1,370)
Loss on disposal of property and equipment	3,617	5,678	3,689
Gain on divestiture of business, net	—	—	(1,360)
Bad debt expense	869	7,349	2,681
Deferred rent	(2,045)	7,085	1,730
Amortization (accretion) of bond premium (discount)	(4,313)	431	1,489
Changes in operating assets and liabilities:			
Accounts receivable	(12,556)	(21,203)	(13,324)
Inventory	(162,829)	—	—
Mortgage loans held for sale	(1,161)	—	—
Prepaid expenses and other assets	(34,068)	10,807	(13,260)
Contract cost assets	(41,510)	—	—
Accounts payable	1,311	(373)	856
Accrued expenses and other current liabilities	1,920	19,000	(5,065)
Accrued compensation and benefits	11,291	(4,948)	12,463
Deferred revenue	2,162	2,633	7,794
Other long-term liabilities	1,962	—	1,612
Net cash provided by operating activities	3,850	258,191	8,645
<b>Investing activities</b>			
Proceeds from maturities of investments	399,228	259,227	199,369
Purchases of investments	(901,761)	(407,032)	(175,210)
Proceeds from sales of investments	13,567	—	4,963
Purchases of property and equipment	(66,054)	(66,728)	(62,060)
Purchases of intangible assets	(12,481)	(11,907)	(9,662)
Purchase of equity investment	—	(10,000)	(10,000)
Proceeds from divestiture of business	—	579	3,200
Cash paid for acquisition, net	(55,138)	(11,533)	(16,319)
Net cash used in investing activities	(622,639)	(247,394)	(65,719)
<b>Financing activities</b>			
Proceeds from issuance of 2023 and 2021 Notes, net of issuance costs	364,020	—	447,784
Premiums paid for Capped Call Confirmations	(29,414)	—	(36,616)
Proceeds from issuance of Class C Capital Stock, net of issuance costs	360,345	—	—
Proceeds from borrowing on revolving credit facility	116,700	—	—
Proceeds from borrowing on warehouse lines of credit	482	—	—
Partial repurchase of 2020 Notes	—	—	(370,235)
Proceeds from exercise of stock options	120,074	98,071	31,211
Value of equity awards withheld for tax liability	(70)	(365)	(616)
Contingent merger consideration	(2,000)	—	—
Net cash provided by financing activities	930,137	97,706	71,528



Net increase in cash, cash equivalents and restricted cash during period	311,348	108,503	14,454
Cash, cash equivalents and restricted cash at beginning of period	352,095	243,592	229,138
Cash, cash equivalents and restricted cash at end of period	<u>\$ 663,443</u>	<u>\$ 352,095</u>	<u>\$ 243,592</u>

**Supplemental disclosures of cash flow information**

Cash paid for interest	\$ 15,473	\$ 9,198	\$ 6,325
Noncash transactions:			
Capitalized share-based compensation	\$ 8,590	\$ 11,236	\$ 10,061
Write-off of fully depreciated property and equipment	\$ 22,364	\$ 15,004	\$ 14,564
Write-off of fully amortized intangible assets	\$ 12,999	\$ 5,473	\$ 9,293

See accompanying notes to consolidated financial statements.

**ZILLOW GROUP, INC.**  
**NOTES TO CONSOLIDATED FINANCIAL STATEMENTS**

**Note 1. Organization and Description of Business**

Zillow Group, Inc. operates the largest portfolio of real estate and home-related brands on mobile and the web which focus on all stages of the home lifecycle: renting, buying, selling and financing. Zillow Group is committed to empowering consumers with unparalleled data, inspiration and knowledge around homes and connecting them with great real estate professionals. The Zillow Group portfolio of consumer brands includes Zillow, Trulia, Mortgage Lenders of America, L.L.C. (“MLOA”), StreetEasy, HotPads, Naked Apartments, RealEstate.com and Out East. In addition, Zillow Group provides a comprehensive suite of marketing software and technology solutions to help real estate professionals maximize business opportunities and connect with millions of consumers. Beginning in April 2018, Zillow Offers provides homeowners in certain metropolitan areas with the opportunity to receive offers to purchase their home from Zillow. When Zillow buys a home, it makes certain repairs and lists the home for resale on the open market. Beginning in October 2018, Zillow also provides consumers with the opportunity to receive mortgage financing through MLOA, a licensed mortgage lender. Zillow Group operates a number of business brands for real estate, rental and mortgage professionals, including Mortech, dotloop, Bridge Interactive and New Home Feed. Zillow, Inc. was incorporated as a Washington corporation in December 2004, and we launched the initial version of our website, Zillow.com, in February 2006. Zillow Group, Inc. was incorporated as a Washington corporation in July 2014 in connection with our acquisition of Trulia, Inc. (“Trulia”). Upon the closing of the Trulia acquisition in February 2015, each of Zillow, Inc. and Trulia became wholly owned subsidiaries of Zillow Group.

***Certain Significant Risks and Uncertainties***

We operate in a dynamic industry and, accordingly, can be affected by a variety of factors. For example, we believe that changes in any of the following areas could have a significant negative effect on us in terms of our future financial position, results of operations or cash flows: rates of revenue growth; our ability to manage advertising inventory or pricing; engagement and usage of our products; our investment of resources to pursue strategies that may not prove effective; competition in our market; the stability of the residential real estate market and the impact of interest rate changes; changes in government regulation affecting our business; outcomes of legal proceedings; natural disasters and catastrophic events; scaling and adaptation of existing technology and network infrastructure; management of our growth; our ability to attract and retain qualified employees and key personnel; our ability to successfully integrate and realize the benefits of our past or future strategic acquisitions or investments; protection of customers’ information and other privacy concerns; protection of our brand and intellectual property; and intellectual property infringement and other claims, among other things.

**Note 2. Summary of Significant Accounting Policies**

***Basis of Presentation***

The accompanying consolidated financial statements include Zillow Group, Inc. and its wholly-owned subsidiaries. All intercompany balances and transactions have been eliminated in consolidation. These consolidated financial statements have been prepared in conformity with U.S. generally accepted accounting principles (“GAAP”).

***Use of Estimates***

The preparation of financial statements in conformity with GAAP requires management to make certain estimates, judgments and assumptions that affect the reported amounts of assets and liabilities and the related disclosures at the date of the financial statements, as well as the reported amounts of revenue and expenses during the periods presented. On an ongoing basis, we evaluate our estimates, including those related to the net realizable value of inventory, amortization period and recoverability of contract cost assets, website and software development costs, recoverability of long-lived assets and intangible assets with definite lives, share-based compensation, income taxes, business combinations, and the recoverability of goodwill and indefinite-lived intangible assets, among others. To the extent there are material differences between these estimates, judgments, or assumptions and actual results, our financial statements will be affected.

### ***Concentrations of Credit Risk***

Financial instruments, which potentially subject us to concentrations of credit risk, consist primarily of cash and cash equivalents, investments, accounts receivable and mortgage loans held for sale. We place cash and cash equivalents and investments with major financial institutions, which management assesses to be of high credit quality, in order to limit exposure of our investments.

Credit risk with respect to accounts receivable is dispersed due to the large number of customers. There were no customers that comprised 10% or more of our total accounts receivable as of December 31, 2018 and 2017. Further, our credit risk on accounts receivable is mitigated by the relatively short payment terms that we offer. Collateral is not required for accounts receivable. We maintain an allowance for doubtful accounts such that receivables are stated at net realizable value.

Similarly, our credit risk on mortgage loans held for sale is dispersed due to a large number of customers. Further, our credit risk on mortgage loans held for sale is mitigated by the fact that we typically sell mortgages on the secondary market within a relatively short period of time after the loan is originated.

### ***Cash and Cash Equivalents***

Cash includes demand deposits with banks or financial institutions. Cash equivalents include short-term, highly liquid investments that are both readily convertible to known amounts of cash, and so near their maturity that they present minimal risk of changes in value because of changes in interest rates. Our cash equivalents include only investments with original maturities of three months or less. We regularly maintain cash in excess of federally insured limits at financial institutions.

### ***Short-term Investments***

Our investments consist of fixed income securities, which include U.S. and foreign government agency securities, corporate notes and bonds, commercial paper, municipal securities and certificates of deposit, and are classified as available-for-sale securities. As the investments are available to support current operations, our available-for-sale securities are classified as short-term investments. Available-for-sale securities are carried at fair value with unrealized gains and losses reported as a component of accumulated other comprehensive loss in shareholders' equity, while realized gains and losses and other-than-temporary impairments are reported as a component of net loss based on specific identification. An impairment charge is recorded in the consolidated statements of operations for declines in fair value below the cost of an individual investment that are deemed to be other than temporary. We assess whether a decline in value is temporary based on the length of time that the fair market value has been below cost, the severity of the decline and the intent and ability to hold or sell the investment. We did not identify any investments as other-than-temporarily impaired as of December 31, 2018 or 2017.

### ***Restricted Cash***

Restricted cash consists of amounts funded to the reserve and collection accounts related to our Revolving Credit Facility (see Note 14) and amounts held in escrow related to funding home purchases in our mortgage originations business.

### ***Accounts Receivable and Allowance for Doubtful Accounts***

Accounts receivable represent our unconditional right to consideration. Accounts receivable are generally due within 30 days and are recorded net of the allowance for doubtful accounts. We consider accounts outstanding longer than the contractual terms past due. We review accounts receivable on a regular basis and estimate an amount of losses for uncollectible accounts based on our historical collections experience, age of the receivable, knowledge of the customer and the condition of the general economy and industry as a whole. We record changes in our estimate to the allowance for doubtful accounts through bad debt expense and relieve the allowance when accounts are ultimately determined to be uncollectible. Bad debt expense is included in general and administrative expenses.

### ***Mortgage Loans Held for Sale***

Mortgage loans held for sale includes residential mortgages originated for sale in the secondary market in connection with our October 2018 acquisition of MLOA. We have elected the fair value option for all mortgage loans held for sale as election of

this option allows for a better offset of the changes in fair values of the loans and the derivative instruments used to economically hedge them without having to apply complex hedge accounting provisions. Mortgage loans held for sale are initially recorded at fair value based on either sale commitments or current market quotes and are adjusted for subsequent changes in fair value until the loans are sold. Net origination costs and fees associated with mortgage loans are recognized at the time of origination. We sell substantially all of the mortgages we originate and the related servicing rights to third-party purchasers. Interest income is earned from the date a mortgage loan is originated until the loan is sold and is classified within other income in the consolidated statements of operations.

Substantially all of the mortgage loans originated are sold within a short period of time in the secondary mortgage market on a servicing released, nonrecourse basis, which limits exposure to nonperformance by loan buyer counterparties although we remain liable for certain limited representations and warranties related to loan sales, such as non-compliance with defined loan origination or documentation standards, including misstatement in the loan documents, early payoff or default on payments. Mortgage investors could seek to have us buy back loans or compensate them for losses incurred on mortgages we have sold based on claims that we breached our limited representations and warranties. We have established reserves for probable losses.

### ***Loan Commitments and Related Derivatives***

We are party to interest rate lock commitments (“IRLCs”), which are extended to borrowers who have applied for loan funding and meet defined credit and underwriting criteria in connection with our October 2018 acquisition of MLOA. IRLCs are accounted for as derivative instruments recorded at fair value with gains and losses recognized in revenue in the consolidated statements of operations. We manage our interest rate risk related to IRLCs and mortgage loans held for sale through the use of derivative instruments, generally forward contracts on mortgage-backed securities (“MBS”), which are commitments to either purchase or sell a specified financial instrument at a specified future date for a specified price, and mandatory loan commitments, which are an obligation by an investor to buy loans at a specified price within a specified time period. We do not enter into or hold derivatives for trading or speculative purposes and our derivatives are not designated as hedging instruments. Changes in the fair value of our derivative financial instruments are recognized in revenues in our consolidated statements of operations, and the fair values are reflected in other assets or other liabilities, as applicable. The net change in fair value was not significant for the year ended December 31, 2018.

There are no credit-risk-related contingent features within our derivative agreements, and counterparty risk is considered minimal. Gains and losses on IRLCs are substantially offset by corresponding gains or losses on forward contracts on mortgage-backed securities and mandatory loan commitments. We are generally not exposed to variability in cash flows of derivative instruments for more than approximately 90 days.

### ***Inventory***

Inventory is comprised of homes acquired through our Zillow Offers program and is stated at the lower of cost or net realizable value. Homes are removed from inventory on a specific identification basis when they are resold. Stated cost includes consideration paid to acquire and update each home including associated allocated overhead costs. Work-in-progress inventory includes homes undergoing updates and finished goods inventory includes homes ready for resale. Unallocated overhead costs are expensed as incurred and included in cost of revenue. Selling costs, including commissions, escrow and title fees, staging, and holding costs, including utilities, taxes and maintenance, are expensed as incurred and included in sales and marketing expenses.

Each quarter we review the value of homes held in inventory for indicators that net realizable value is lower than cost. When evidence exists that the net realizable value of inventory is lower than its cost, the difference is recognized in cost of revenue.

### ***Contract Cost Assets***

We capitalize certain incremental costs of obtaining contracts with customers which we expect to recover. These costs relate to commissions paid to sales personnel, primarily for our Premier Agent and Premier Broker programs. As a practical expedient, we recognize the incremental costs of obtaining a contract as an expense when incurred if the amortization period of the asset that we otherwise would have recognized is one year or less. Capitalized commission costs are recorded as contract

cost assets in our consolidated balance sheets. Contract cost assets are amortized to expense on a straight-line basis over a period that is consistent with the transfer to the customer of the products or services to which the asset relates, generally the estimated life of the customer relationship. Amortization expense related to contract cost assets is included in sales and marketing expenses in our consolidated statements of operations. In determining the estimated life of our customer relationships, we consider quantitative and qualitative data, including, but not limited to, historical customer data, recent changes or expected changes in product or service offerings, and changes in how we monetize our products and services. The amortization period for capitalized contract costs related to our Premier Agent and Premier Broker programs ranges from two to three years.

### ***Property and Equipment***

Property and equipment is recorded at cost and depreciated using the straight-line method over the estimated useful lives of the related assets. The useful lives are as follows:

Computer equipment	2 to 3 years
Office equipment, furniture and fixtures	5 to 7 years
Leasehold improvements	Shorter of expected useful life or lease term

Maintenance and repair costs are charged to expense as incurred. Major improvements, which extend the useful life of the related asset, are capitalized. Upon disposal of a fixed asset, we record a gain or loss based on the difference between the proceeds received and the net book value of the disposed asset.

### ***Website and Software Development Costs***

The costs incurred in the preliminary stages of development are expensed as incurred. Once an application has reached the development stage, internal and external costs, if direct and incremental and deemed by management to be significant, are capitalized in property and equipment and amortized on a straight-line basis over their estimated useful lives. Maintenance and enhancement costs, including those costs in the post-implementation stages, are typically expensed as incurred, unless such costs relate to substantial upgrades and enhancements to the website or software that result in added functionality, in which case the costs are capitalized and amortized on a straight-line basis over the estimated useful lives. Amortization expense related to capitalized website and software development costs is included in technology and development expense.

Capitalized development activities placed in service are amortized over the expected useful lives of those releases, currently estimated at one to three years. The estimated useful lives of website and software development activities are reviewed frequently and adjusted as appropriate to reflect upcoming development activities that may include significant upgrades and/or enhancements to the existing functionality.

Construction-in-progress primarily consists of website development costs that are capitalizable, but for which the associated applications had not been placed in service.

### ***Recoverability of Goodwill and Indefinite-Lived Intangible Assets***

Goodwill represents the excess of the cost of an acquired business over the fair value of the assets acquired at the date of acquisition, and is not amortized. We assess the impairment of goodwill on an annual basis, in our fourth quarter, or whenever events or changes in circumstances indicate that goodwill may be impaired. Typically, we choose to forgo the initial qualitative assessment and perform a quantitative analysis to assist in our annual evaluation. If impairment exists, the carrying value of the goodwill is reduced to fair value through an impairment charge recorded in our statements of operations.

Our indefinite-lived intangible asset is not amortized, and we assess the asset for impairment on an annual basis, in our fourth quarter, or whenever events or changes in circumstances indicate that the asset may be impaired. On an interim basis we consider if there are any events and circumstances that could affect the significant inputs used to determine the fair value of the indefinite-lived intangible asset, including, but not limited to, costs that could have a negative effect on future expected earnings and cash flows, changes in certain key performance metrics, and changes in management, key personnel, strategy or

customers. In our evaluation of our trade names and trademarks indefinite-lived intangible asset, we typically first perform a qualitative assessment to determine whether the fair value of the indefinite-lived intangible asset is more likely than not impaired. If so, we perform a quantitative assessment and an impairment charge is recorded in our statements of operations for the excess of the carrying value of the indefinite-lived intangible asset over its fair value.

During the years ended December 31, 2018 and December 31, 2017, we recorded non-cash impairments for \$69.0 million and \$174.0 million related to the indefinite-lived Trulia trade names and trademarks intangible asset. For additional information about the non-cash impairments, see Note 11 to our consolidated financial statements.

### ***Intangible Assets***

We purchase and license data content from multiple data providers. This data content consists of U.S. county data about home details (e.g., the number of bedrooms, bathrooms, square footage) and other information relating to the purchase price of homes, both current and historical, as well as imagery, mapping and parcel data that is displayed on our mobile applications and websites. Our home details data not only provides information about a home and its related transactions which is displayed on our mobile applications and websites, but is also used in our proprietary valuation algorithms to produce Zestimates, Rent Zestimates and Zillow Home Value Indexes. License agreement terms vary by vendor. In some instances, we retain perpetual rights to this information after the contract ends; in other instances, the information and data are licensed only during the fixed term of the agreement. Additionally, certain data license agreements provide for uneven payment amounts throughout the contract term.

We capitalize payments made to third parties for data licenses that we expect to provide future economic benefit through the recovery of the costs of these arrangements via the generation of our revenue and margins. For data license contracts that include uneven payment amounts, we capitalize the payments as they are made as an intangible asset and the total contract value is typically amortized on a straight-line basis over the term of the contract, which is equivalent to the estimated useful life of the asset. We evaluate data content contracts for potential capitalization at the inception of the arrangement as well as each time periodic payments to third parties are made.

The amortization period for the capitalized purchased content is based on our best estimate of the useful life of the asset, which is approximately five years. The determination of the useful life includes consideration of a variety of factors including, but not limited to, our assessment of the expected use of the asset and contractual provisions that may limit the useful life, as well as an assessment of when the data is expected to become obsolete based on our estimates of the diminishing value of the data over time. We evaluate the useful life of the capitalized purchased data content each reporting period to determine whether events and circumstances warrant a revision to the remaining useful life. If we determine the estimate of the asset's useful life requires modification, the carrying amount of the asset is amortized prospectively over the revised useful life. The capitalized purchased data content is amortized on a straight-line basis as the pattern of delivery of the economic benefits of the data cannot reliably be determined because we do not have the ability to reliably predict future traffic to our mobile applications and websites.

Under certain other data agreements, the underlying data is obtained on a subscription basis with consistent monthly or quarterly recurring payment terms over the contractual period. Upon the expiration of such arrangements, we no longer have the right to access the related data, and therefore, the costs incurred under such contracts are not capitalized and are expensed as payments are made. We would immediately lose rights to data under these arrangements if we were to cancel the subscription and/or cease making payments under the subscription arrangements.

We also capitalize costs related to the license of certain internal-use software from third parties, including certain licenses of software in cloud computing arrangements. Additionally, we capitalize costs incurred during the application development stage related to the development of internal-use software and enterprise cloud computing services. We expense costs as incurred related to the planning and post-implementation phases of development. Capitalized internal-use software costs are amortized over the estimated useful life of the asset, which is currently one to 3 years, on a straight-line basis.



Intangibles-in-progress consist of purchased content and software that are capitalizable but have not been placed in service.

We also have intangible assets for developed technology, customer relationships, trade names and trademarks and advertising relationships which we recorded in connection with acquisitions. Purchased intangible assets with a determinable economic life are carried at cost, less accumulated amortization. These intangible assets are amortized over the estimated useful life of the asset on a straight-line basis.

#### ***Recoverability of Intangible Assets with Definite Lives and Other Long-Lived Assets***

We evaluate intangible assets and other long-lived assets for impairment whenever events or circumstances indicate that they may not be recoverable. Recoverability is measured by comparing the carrying amount of an asset group to future undiscounted net cash flows expected to be generated. We group assets for purposes of such review at the lowest level for which identifiable cash flows of the asset group are largely independent of the cash flows of the other groups of assets and liabilities. If this comparison indicates impairment, the amount of impairment to be recognized is calculated as the difference between the carrying value and the fair value of the asset group.

#### ***Deferred Revenue***

Deferred revenue consists of prepaid advertising fees received or billed in advance of satisfying our performance obligations and prepaid but unrecognized subscription revenue. Deferred revenue is recognized when or as we satisfy our obligations under contracts with customers.

#### ***Deferred Rent***

For our operating leases, we recognize rent expense on a straight-line basis over the terms of the leases and, accordingly, we record the difference between cash rent payments and the recognition of rent expense as a deferred rent liability. For office space under an operating lease that is subleased to a third party for which we intend to reoccupy the space at a future date, rent expense is recognized net of sublease income. Landlord-funded leasehold improvements are also recorded as deferred rent liabilities and are amortized as a reduction of rent expense over the non-cancelable term of the related operating lease.

#### ***Business Combinations***

We recognize identifiable assets acquired and liabilities assumed at their acquisition date fair values. Goodwill as of the acquisition date is measured as the excess of consideration transferred over the net of the acquisition date fair values of the assets acquired and the liabilities assumed. While we use our best estimates and assumptions for the purchase price allocation process to value assets acquired and liabilities assumed at the acquisition date, our estimates are inherently uncertain and subject to refinement. As a result, during the measurement period, which may be up to one year from the acquisition date, we record adjustments to the assets acquired and liabilities assumed, with the corresponding offset to goodwill to the extent that we identify adjustments to the preliminary purchase price allocation. Upon the conclusion of the measurement period or final determination of the values of assets acquired or liabilities assumed, whichever comes first, any subsequent adjustments are recorded to our consolidated statements of operations. We recognize adjustments to provisional amounts that are identified during the measurement period in the reporting period in which the adjustment amounts are determined.

#### ***Revenue Recognition***

We recognize revenue when (or as) we satisfy our performance obligations by transferring control of the promised products or services to our customers in an amount that reflects the consideration to which we expect to be entitled in exchange for those products or services.

As a practical expedient, we do not adjust the promised amount of consideration for the effects of a significant financing component as the period between our transfer of a promised product or service to a customer and when the customer pays for that product or service is one year or less.

We do not disclose the transaction price related to remaining performance obligations for (i) contracts with an original expected duration of one year or less and (ii) contracts for which we recognize revenue at the amount to which we have the right to invoice for performance completed to date. The remaining duration of our performance obligations is generally less than one year.

In our Internet, Media & Technology (“IMT”) segment, we generate revenue from the sale of advertising services and our suite of marketing software and technology solutions to businesses and professionals primarily associated with the residential real estate, rental and mortgage industries. These professionals include real estate, rental and mortgage professionals and brand advertisers. Our four primary revenue categories within our IMT segment are Premier Agent, Rentals, Mortgages and Other.

In our Homes segment, we generate revenue from the resale of homes on the open market through our Zillow Offers program.

**Premier Agent Revenue.** Premier Agent revenue is derived from our Premier Agent and Premier Broker programs. Our Premier Agent and Premier Broker programs offer a suite of marketing and business technology products and services to help real estate agents and brokers achieve their advertising goals, while growing and managing their businesses and brands. All Premier Agents and Premier Brokers receive access to a dashboard portal on our mobile application or website that provides individualized program performance analytics, our customer relationship management, or CRM, tool that captures detailed information about each contact made with a Premier Agent or Premier Broker through our mobile and web platforms and our account management tools. We have concluded that the marketing and business technology products and services promised to Premier Agents and Premier Brokers represent distinct performance obligations.

We primarily offer our Premier Agent and Premier Broker advertising products on a cost per impression basis. Payment is received prior to the delivery of impressions. Impressions are delivered when a sold advertisement appears on pages viewed by users of our mobile applications and websites. We determine the cost per impression delivered in each zip code using an auction-based pricing method in consideration of the total amount spent by Premier Agents and Premier Brokers to purchase impressions in the zip code during the month. A Premier Agent’s or Premier Broker’s share of voice in a zip code is determined by their proportional monthly budgeted spend in that zip code as a percentage of the total monthly budgeted spend of all Premier Agents and Premier Brokers in that zip code. The cost per impression that we charge is dynamic - as demand for impressions in a zip code increases or decreases, the cost per impression in that zip code may be increased or decreased accordingly. The price paid for each impression is representative of the price at which we would sell an impression separately to a customer, or the stand-alone selling price.

We have not allocated the transaction price to each performance obligation as the amounts recognized would be the same irrespective of any allocation. As such, we recognize revenue related to the Premier Agent and Premier Broker products and services based on the contractual spend recognized on a straight-line basis during the contractual period over which the products and services are provided. This methodology best depicts how we satisfy our performance obligations to customers, as we continuously transfer control of the performance obligations to the customer throughout the contractual period.

In October 2018, we began testing a new Flex Pricing model for Premier Broker and Premier Agent advertising services in limited markets. With the Flex Pricing model, Premier Brokers and Premier Agents are provided with validated leads at no upfront cost, and they pay a performance advertising fee only when a real estate transaction is closed with one of their leads. With this pricing model, the transaction price represents variable consideration as the amount to which we expect to be entitled varies based on the number of validated leads that convert into real estate transactions.

**Rentals Revenue.** Rentals revenue includes our rentals marketplace and suite of tools for rental professionals. Rentals revenue primarily includes revenue generated by advertising sold to property managers and other rental professionals on a cost per lead, cost per click or cost per lease generated basis. We recognize revenue as leads or clicks are provided to rental professionals, which is the amount for which we have the right to invoice. The number of leases generated through our rentals marketplace during the period is accounted for as variable consideration, and we estimate these amounts based on the expected number of qualified leases secured during the period. We do not believe that a significant reversal in the amount of cumulative revenue recognized will occur once the uncertainty related to the number of leases secured is subsequently resolved.

Beginning in 2018, rentals revenue also includes revenue generated from Zillow's rental applications product through which potential renters can submit applications to multiple rental properties over a 30-day period for a flat service fee. We recognize revenue for the rental applications product on a straight-line basis during the contractual period over which the customer has the right to access and submit the rental application.

***Mortgages Revenue.*** Mortgages revenue primarily includes marketing products sold to mortgage professionals on a cost per lead basis, including our Custom Quote and a portion of our Connect (formerly known as Long Form) services, and on a subscription basis, including a portion of our Connect service. For our Connect and Custom Quote cost per lead mortgage marketing products, participating qualified mortgage professionals typically make a prepayment to gain access to consumers interested in connecting with mortgage professionals. Mortgage professionals who exhaust their initial prepayment prepay additional funds to continue to participate in the marketplace. For our Connect subscription mortgage marketing product, participating qualified mortgage professionals generally prepay a monthly subscription fee, which they then allocate to desired geographic counties. In Zillow Group's Connect platform, consumers answer a series of questions to find a local lender, and mortgage professionals receive consumer contact information, or leads, when the consumer chooses to share their information with a lender. Consumers who request rates for mortgage loans in Custom Quotes are presented with customized quotes from participating mortgage professionals.

For our cost per lead mortgages products, we recognize revenue when a user contacts a mortgage professional through Zillow Group's mortgages platform, which is the amount for which we have the right to invoice. For our Connect subscription product, the opportunity to receive a consumer contact is based on the mortgage professional's relative share of voice in a geographic county. When a consumer submits a contact, Zillow Group contacts a group of subscription mortgage professionals via text message, and the first mortgage professional to respond receives the consumer contact information. We recognize revenue based on the contractual spend recognized on a straight-line basis during the contractual period over which the service is provided. This methodology best depicts how we satisfy our performance obligation to subscription customers, as we continuously transfer control of the performance obligation to the customer throughout the contractual period.

Beginning in October 2018, mortgages revenue also includes revenue generated from our mortgage originations business. We elect the fair value option for our mortgage loans held for sale, which are initially recorded at fair value based on either sale commitments or current market quotes and are adjusted for subsequent changes in fair value until the loans are closed.

Mortgages revenue also includes revenue generated by Mortech, which provides subscription-based mortgage software solutions, including a product and pricing engine and lead management platform, for which we recognize revenue on a straight-line basis during the contractual period over which the services are provided.

***Other Revenue.*** Other revenue primarily includes revenue generated by new construction and display, as well as revenue from the sale of various other marketing and business products and services to real estate professionals. Our new construction marketing solutions allow home builders to showcase their available inventory to home shoppers. New construction revenue primarily includes revenue generated by advertising sold to builders on a cost per residential community basis, and revenue is recognized on a straight-line basis during the contractual period over which the communities are advertised on our mobile applications and websites. Consideration is billed in arrears. Display revenue primarily consists of graphical mobile and web advertising sold on a cost per thousand impressions or cost per click basis to advertisers promoting their brands on our mobile applications and websites. We recognize display revenue as clicks occur or as impressions are delivered to users interacting with our mobile applications or websites, which is the amount for which we have the right to invoice.

***Homes Revenue.*** Homes revenue is derived from the resale of homes on the open market through our Zillow Offers program. Homes revenue is recognized at the time of the closing of the home sale when title to and possession of the property are transferred to the buyer.

There were no customers that generated 10% or more of our total revenue in the years ended December 31, 2018, 2017 or 2016.

### ***Cost of Revenue***

For our IMT segment, our cost of revenue consists of expenses related to operating our mobile applications and websites, including associated headcount expenses, such as salaries and benefits and share-based compensation expense and bonuses, as well as credit card fees, ad serving costs paid to third parties, revenue-sharing costs related to our commercial business relationships, depreciation expense and costs associated with the operation of our data center and mobile applications and websites. Beginning in the fourth quarter of 2018, cost of revenue within the IMT segment also includes expenses associated with our mortgage originations business, such as origination costs and fees, lead acquisition costs and expenses related to systems used directly in the origination of mortgages. For our Homes segment, our cost of revenue also consists of the consideration paid to acquire and make necessary updates to each home including associated overhead costs.

### ***Technology and Development***

Technology and development expenses consist of headcount expenses, including salaries, benefits, share-based compensation expense and bonuses for salaried employees and contractors engaged in the design, development and testing of our mobile applications and websites and the tools and applications that support our products, and equipment and maintenance costs. Technology and development expenses also include amortization costs related to capitalized website and development activities, amortization of software, amortization of certain intangibles and other data agreement costs related to the purchase of data used to populate our mobile applications and websites, amortization of intangible assets recorded in connection with acquisitions, including developed technology and customer relationships, amongst others, and depreciation expense.

Research and development costs are expensed as incurred and are recorded in technology and development expenses. For the years ended December 31, 2018, 2017 and 2016, expenses attributable to research and development for our business totaled \$298.1 million, \$193.0 million and \$170.1 million, respectively.

### ***Share-Based Compensation***

We measure compensation expense for all share-based awards at fair value on the date of grant and recognize compensation expense over the service period on a straight-line basis for awards expected to vest.

We use the Black-Scholes-Merton option-pricing model to determine the fair value for option awards. In valuing our option awards, we make assumptions about risk-free interest rates, dividend yields, volatility, and weighted-average expected lives. In addition, through December 31, 2016, we made assumptions about estimated forfeiture rates. Beginning on January 1, 2017, we elected to account for forfeitures as they occur. Risk-free interest rates are derived from U.S. Treasury securities as of the option award grant date. Expected dividend yield is based on our historical cash dividend payments, which have been zero to date. The expected volatility for our Class A common stock and Class C capital stock is estimated using our historical volatility. The weighted-average expected life of the option awards is estimated based on our historical exercise data. Prior to January 1, 2017, forfeiture rates were estimated using historical actual forfeiture trends as well as our judgment of future forfeitures. These rates were evaluated at least quarterly and any change in share-based compensation expense was recognized in the period of the change. We considered many factors when estimating expected forfeitures, including employee class and historical experience.

For issuances of restricted stock units and restricted units, we determine the fair value of the award based on the market value of our Class A common stock or Class C capital stock, as applicable, at the date of grant.

### ***Advertising Costs***

Advertising costs are expensed as incurred. For the years ended December 31, 2018, 2017 and 2016, expenses attributable to advertising totaled \$177.3 million, \$156.5 million and \$120.2 million, respectively. Advertising costs are recorded in sales and marketing expenses.

### ***Income Taxes***

We use the asset and liability approach for accounting and reporting income taxes, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of temporary differences between the financial

statement and tax bases of assets and liabilities at the applicable enacted tax rates. A valuation allowance against deferred tax assets would be established if, based on the weight of available evidence, it is more likely than not (a likelihood of more than 50%) that some or all of the deferred tax assets are not expected to be realized.

We establish reserves for tax-related uncertainties based on estimates of whether, and the extent to which, additional taxes will be due. We adjust these reserves in light of changing facts and circumstances, such as the closing of a tax audit, new tax legislation or the change of an estimate. To the extent that the final tax outcome of these matters is different than the amounts recorded, such differences will affect the provision for income taxes in the period in which such determination is made. Interest and penalties related to unrecognized tax benefits are recorded as income tax expense.

On December 22, 2017, the U.S. government enacted comprehensive tax legislation under the Tax Cuts and Jobs Act (the “Tax Act”). The Tax Act makes broad and complex changes to the U.S. tax code, including but not limited to: (1) reducing the U.S. federal corporate tax rate from 35 percent to 21 percent; (2) requiring companies to pay a one-time transition tax on certain unrepatriated earnings of foreign subsidiaries; (3) generally eliminating U.S. federal income taxes on dividends from foreign subsidiaries; (4) eliminating the corporate alternative minimum tax (“AMT”) and how AMT credits are utilized; (5) the additional limitations on deducting executive compensation under IRC Section 162(m); and (6) changing rules related to uses and limitations of net operating loss carryforwards created in tax years beginning after December 31, 2017. Shortly after enactment, implementation guidance was released by the Securities and Exchange Commission that requires a company to reflect the income tax effects of those aspects of the Tax Act for which the accounting under the accounting rules is complete. To the extent that a company’s accounting for certain income tax effects of the Tax Act is incomplete but the company is able to determine a reasonable estimate, it should record a provisional estimate in the financial statements. Further, the implementation guidance also provides for a measurement period that should not extend beyond one year from the Tax Act enactment date for companies to complete their accounting pursuant to the accounting rules.

### ***Recently Adopted Accounting Standards***

In December 2016, the Financial Accounting Standards Board (“FASB”) issued guidance to narrow the definition of a business. This guidance assists entities with evaluating when a set of transferred assets and activities is a business. This guidance is effective for interim and annual reporting periods beginning after December 15, 2017, and early adoption is permitted. This guidance must be applied prospectively to transactions occurring within the period of adoption. We adopted this guidance on January 1, 2018. The adoption of this guidance did not have an impact on our financial position, results of operations or cash flows.

In January 2016, the FASB issued guidance on the recognition and measurement of financial instruments. This guidance generally requires equity investments, except those accounted for under the equity method of accounting or those that result in consolidation of the investee, to be measured at fair value with changes in fair value recognized in net income (loss). An entity may elect to measure equity securities that do not have readily determinable fair values and do not qualify for the net asset value per share practical expedient at cost minus impairment, if any, plus or minus changes resulting from observable price changes in orderly transactions for the identical or a similar investment of the same issuer. The guidance also requires the separate presentation of financial assets and financial liabilities by measurement category and form of financial asset on the balance sheet or the accompanying notes to the financial statements. This guidance is effective for interim and annual reporting periods beginning after December 15, 2017, early adoption is permitted, and the guidance must be applied prospectively to equity investments that exist as of the adoption date. We adopted this guidance, and the February 2018 amendment to this guidance, effective January 1, 2018. The adoption of this guidance did not have any impact on our financial position, results of operations or cash flows.

In May 2014, the FASB issued guidance on revenue from contracts with customers. The guidance states that an entity should recognize revenue to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those products or services. It also states that an entity should recognize as an asset the incremental costs of obtaining a contract that the entity expects to recover and amortize the costs consistent with the transfer to the customer of the products or services to which the asset relates. The guidance requires more detailed disclosures to enable users of financial statements to understand the nature, amount, timing, and uncertainty of

revenue and cash flows arising from contracts with customers. We adopted this guidance effective January 1, 2018 using the modified retrospective transition approach applied to all contracts at the date of initial application. We recorded an adjustment of \$40.3 million to decrease accumulated deficit as of January 1, 2018 related to the accounting for the cost of sales commissions, primarily related to sales commissions for our Premier Agent and Premier Broker advertising products. Historically, we expensed these sales commission costs as incurred, but under the new guidance, the cost of certain sales commissions is recorded as a contract cost asset and recognized as an operating expense over the period that we expect to recover the costs.

The amount by which each financial statement line item is affected by the application of this guidance as of and for the year ended December 31, 2018 is as follows (in thousands, except per share data):

	New Guidance	Prior Guidance	Change
<b>Consolidated Statement of Operations:</b>			
Sales and marketing	\$ 552,621	\$ 558,118	\$ (5,497)
Total costs and expenses	1,462,529	1,468,026	(5,497)
Loss from operations	(128,975)	(134,472)	5,497
Loss before income taxes	(150,960)	(156,457)	5,497
Income tax benefit	31,102	32,024	(922)
Net loss	(119,858)	(124,433)	4,575
Net loss per share — basic and diluted	(0.61)	(0.63)	0.02
<b>Consolidated Balance Sheet:</b>			
Contract cost assets	45,819	—	45,819
Total assets	4,291,116	4,245,297	45,819
Deferred tax liabilities and other long-term liabilities	17,474	16,552	922
Total liabilities	1,023,937	1,023,015	922
Accumulated deficit	(671,779)	(716,676)	44,897
Total shareholders' equity	3,267,179	3,222,282	44,897
Total liabilities and shareholders' equity	\$ 4,291,116	\$ 4,245,297	\$ 45,819

### ***Recently Issued Accounting Standards Not Yet Adopted***

In August 2018, the FASB issued guidance related to a customer's accounting for implementation costs incurred in hosting arrangements. The guidance aligns the requirements for capitalizing implementation costs incurred in cloud computing arrangements with the requirements for capitalizing costs to develop or obtain internal-use software. This guidance is effective for interim and annual reporting periods beginning after December 15, 2019, and early adoption is permitted. This guidance may be applied either retrospectively or prospectively. We expect to adopt this guidance on January 1, 2020. We have not yet determined the impact the adoption of this guidance will have on our financial position, results of operations or cash flows.

In August 2018, the FASB issued guidance related to disclosure requirements for fair value measurements. This guidance removes, modifies and adds disclosures related to fair value measurements. This guidance is effective for interim and annual periods beginning after December 15, 2019, and early adoption is permitted. The amendments on changes in unrealized gains and losses, the range and weighted average of significant unobservable inputs used to develop Level 3 fair value measurements and the narrative description of measurement uncertainty should be applied prospectively for only the most recent interim and annual period presented in the initial fiscal year of adoption. All other amendments should be applied retrospectively to all periods presented upon their effective date. We expect to adopt this guidance on January 1, 2020. We have not yet determined the impact the adoption of this guidance will have on our financial statement disclosures.



In June 2018, the FASB issued guidance related to contributions received and made. This guidance assists entities with evaluating whether a transfer of assets is considered a contribution or an exchange transaction. This guidance is effective for interim and annual reporting periods beginning after June 15, 2018 for contributions received and after December 15, 2018 for contributions made, and early adoption is permitted. The guidance should be applied on a modified prospective basis, though retrospective application is permitted. We adopted this guidance on January 1, 2019. The adoption of this guidance is not expected to have a material impact on our financial position, results of operations or cash flows.

In February 2018, the FASB issued guidance on income tax accounting related to the Tax Act. This guidance permits a reclassification from accumulated other comprehensive income (loss) to accumulated deficit for the adjustment of deferred taxes due to the reduction of the historical corporate income tax rate to the newly enacted corporate income tax rate under the Tax Act. It also requires certain disclosures regarding these reclassifications. The guidance is effective for interim and annual reporting periods beginning after December 15, 2018, and early adoption is permitted. This guidance must be applied either on a prospective basis in the period of adoption or retrospectively to each period in which the effect of the change in the corporate income tax rate is recognized. We adopted this guidance on January 1, 2019. The adoption of this guidance is not expected to have a material impact on our financial position, results of operations or cash flows.

In March 2017, the FASB issued guidance related to the premium amortization on purchased callable debt securities. This guidance shortens the amortization period for certain callable debt securities purchased at a premium by requiring that the premium be amortized to the earliest call date. This guidance is effective for interim and annual reporting periods beginning after December 15, 2018, and early adoption is permitted. This guidance must be applied on a modified retrospective basis through a cumulative-effect adjustment directly to retained earnings as of the beginning of the period of adoption. We adopted this guidance on January 1, 2019. The adoption of this guidance is not expected to have a material impact on our financial position, results of operations or cash flows.

In June 2016, the FASB issued guidance on the measurement of credit losses on financial instruments. This guidance requires the use of an expected loss impairment model for instruments measured at amortized cost. For available-for-sale debt securities, an entity is required to recognize credit losses through an allowance for credit losses rather than as a write-down. This guidance is effective for interim and annual reporting periods beginning after December 15, 2019, and early adoption is permitted for interim and annual reporting periods beginning after December 15, 2018. The adoption of this guidance requires a cumulative-effect adjustment to retained earnings as of the beginning of the first reporting period in which the guidance is effective. We expect to adopt this guidance on January 1, 2020. We have not yet determined the impact the adoption of this guidance will have on our financial position, results of operations or cash flows.

In February 2016, the FASB issued guidance on leases. This guidance requires the recognition of a right-of-use asset and lease liability on the balance sheet for all leases. This guidance also requires more detailed disclosures to enable users of financial statements to understand the amount, timing, and uncertainty of cash flows arising from leases. This guidance is effective for interim and annual reporting periods beginning after December 15, 2018. In July 2018, the FASB issued certain targeted improvements to the accounting and disclosure requirements for leases, including an additional optional transition method that allows entities to initially apply the new standard at the adoption date and recognize a cumulative-effect adjustment to the opening balance of retained earnings in the period of adoption without restating prior periods. When adopting the lease guidance, an entity may elect a practical expedient package, under which it need not reassess (a) whether any expired or existing contracts are or contain leases; (b) the lease classification for any expired or existing leases; and (c) initial direct costs for any existing leases. These three practical expedients must be elected as a package and must be consistently applied to all existing leases at the date of adoption. We adopted the new guidance on leases on January 1, 2019 using the optional transition method and electing to adopt the practical expedient package. Under this approach, we will not restate the prior financial statements presented. Based on our lease portfolio as of December 31, 2018, we anticipate recording on our consolidated balance sheet right-of-use assets of approximately \$90 million as well as operating lease liabilities of approximately \$115 million with no material impact to our consolidated statements of operations or cash flows.

**Note 3. Fair Value Measurements**

Accounting standards define fair value as the price that would be received to sell an asset or paid to transfer a liability (an exit price) in the principal or most advantageous market in an orderly transaction between market participants on the measurement date. The standards also establish a fair value hierarchy, which requires an entity to maximize the use of observable inputs and minimize the use of unobservable inputs when measuring fair value. There are three levels of inputs that may be used to measure fair value:

- Level 1—Quoted prices in active markets for identical assets or liabilities.
- Level 2—Assets and liabilities valued based on observable market data for similar instruments, such as quoted prices for similar assets or liabilities.
- Level 3—Unobservable inputs that are supported by little or no market activity; instruments valued based on the best available data, some of which is internally developed, and considers risk premiums that a market participant would require.

We applied the following methods and assumptions in estimating our fair value measurements:

*Cash equivalents*—The fair value measurement of money market funds is based on quoted market prices in active markets. The fair value measurement of corporate notes and bonds, commercial paper, U.S. government agency securities and certificates of deposit is based on observable market-based inputs or inputs that are derived principally from or corroborated by observable market data by correlation or other means.

*Short-term investments*—The fair value measurement of our short-term investments is based on observable market-based inputs or inputs that are derived principally from or corroborated by observable market data by correlation or other means.

*Restricted cash*—The carrying value of restricted cash approximates fair value due to the short period of time amounts borrowed on the Revolving Credit Facility (see Note 14) are outstanding. Further, the carrying value of restricted cash related to escrow amounts held as part of the mortgage originations business also approximates fair value due to the short period of time amounts are held in escrow before they are transferred to the appropriate party, typically a home seller or bank.

*Mortgage loans held for sale*—The fair value of mortgage loans held for sale is generally calculated by reference to quoted prices in secondary markets for commitments to sell mortgage loans with similar characteristics.

*Interest rate lock commitments*—The fair value of interest rate lock commitments is calculated by reference to quoted prices in secondary markets for commitments to sell mortgage loans with similar characteristics. Any expired commitments are excluded from the fair value measurement. We generally only issue IRLCs for products that meet specific purchaser guidelines. Since not all IRLCs will become closed loans, we adjust our fair value measurements for the estimated amount of IRLCs that will not close.

*Forward contracts*—The fair value of mandatory loan sales commitments and derivative instruments such as forward sales of MBS that are utilized as hedging instruments are calculated by reference to quoted prices for similar assets.

The following tables present the balances of assets measured at fair value on a recurring basis, by level within the fair value hierarchy, as of the dates presented (in thousands):

	<b>December 31, 2018</b>		
	<b>Total</b>	<b>Level 1</b>	<b>Level 2</b>
<b>Cash equivalents:</b>			
Money market funds	\$ 541,575	\$ 541,575	\$ —
Commercial paper	3,999	—	3,999
<b>Short-term investments:</b>			
U.S. government agency securities	646,496	—	646,496
Corporate notes and bonds	112,933	—	112,933
Commercial paper	85,506	—	85,506
Municipal securities	39,306	—	39,306
Foreign government securities	14,915	—	14,915
Certificates of deposit	4,711	—	4,711
<b>Mortgage origination-related:</b>			
Mortgage loans held for sale	35,409	—	35,409
Interest rate lock commitments	847	—	847
Forward contracts	(125)	—	(125)
<b>Total</b>	<b>\$ 1,485,572</b>	<b>\$ 541,575</b>	<b>\$ 943,997</b>

	<b>December 31, 2017</b>		
	<b>Total</b>	<b>Level 1</b>	<b>Level 2</b>
<b>Cash equivalents:</b>			
Money market funds	\$ 233,508	\$ 233,508	\$ —
Corporate notes and bonds	6,199	—	6,199
Commercial paper	3,987	—	3,987
U.S. government agency securities	1,748	—	1,748
Certificates of deposit	249	—	249
<b>Short-term investments:</b>			
U.S. government agency securities	298,758	—	298,758
Corporate notes and bonds	44,607	—	44,607
Commercial paper	39,325	—	39,325
Municipal securities	11,459	—	11,459
Certificates of deposit	10,297	—	10,297
Foreign government securities	5,998	—	5,998
<b>Total</b>	<b>\$ 656,135</b>	<b>\$ 233,508</b>	<b>\$ 422,627</b>

At December 31, 2018, the notional amounts of the hedging instruments related to our mortgage loans held for sale were \$26.7 million and \$28.8 million for our interest rate lock commitments and forward contracts, respectively.

See Note 14 for the carrying amount and estimated fair value of the Company's Convertible Senior Notes due in 2023, Convertible Senior Notes due in 2021 and Trulia's Convertible Senior Notes due in 2020.

We did not have any Level 3 assets as of December 31, 2018 or 2017. There were no material liabilities measured at fair value as of December 31, 2018 or 2017.

**Note 4. Cash and Cash Equivalents, Short-term Investments and Restricted Cash**

The following tables present the amortized cost, gross unrealized gains and losses and estimated fair market value of our cash and cash equivalents, available-for-sale investments and restricted cash as of the dates presented (in thousands):

<b>December 31, 2018</b>				
	<b>Amortized Cost</b>	<b>Gross Unrealized Gains</b>	<b>Gross Unrealized Losses</b>	<b>Estimated Fair Market Value</b>
Cash	\$ 105,484	\$ —	\$ —	\$ 105,484
Cash equivalents:				
Money market funds	541,575	—	—	541,575
Commercial paper	3,999	—	—	3,999
Short-term investments:				
U.S. government agency securities	647,266	51	(821)	646,496
Corporate notes and bonds	113,109	1	(177)	112,933
Commercial paper	85,506	—	—	85,506
Municipal securities	39,316	23	(33)	39,306
Foreign government securities	14,929	—	(14)	14,915
Certificates of deposit	4,711	1	(1)	4,711
Restricted cash	12,385	—	—	12,385
<b>Total</b>	<b>\$ 1,568,280</b>	<b>\$ 76</b>	<b>\$ (1,046)</b>	<b>\$ 1,567,310</b>

<b>December 31, 2017</b>				
	<b>Amortized Cost</b>	<b>Gross Unrealized Gains</b>	<b>Gross Unrealized Losses</b>	<b>Estimated Fair Market Value</b>
Cash	\$ 106,404	\$ —	\$ —	\$ 106,404
Cash equivalents:				
Money market funds	233,508	—	—	233,508
Corporate notes and bonds	6,200	—	(1)	6,199
Commercial paper	3,987	—	—	3,987
U.S. government agency securities	1,748	—	—	1,748
Certificates of deposit	249	—	—	249
Short-term investments:				
U.S. government agency securities	299,814	—	(1,056)	298,758
Corporate notes and bonds	44,661	1	(55)	44,607
Commercial paper	39,325	—	—	39,325
Municipal securities	11,494	—	(35)	11,459
Certificates of deposit	10,296	2	(1)	10,297
Foreign government securities	6,000	—	(2)	5,998
<b>Total</b>	<b>\$ 763,686</b>	<b>\$ 3</b>	<b>\$ (1,150)</b>	<b>\$ 762,539</b>

The following table presents available-for-sale investments by contractual maturity date as of December 31, 2018 (in thousands):

	<b>Amortized Cost</b>	<b>Estimated Fair Market Value</b>
Due in one year or less	\$ 801,828	\$ 800,827
Due after one year through two years	103,009	103,040
<b>Total</b>	<b>\$ 904,837</b>	<b>\$ 903,867</b>

#### **Note 5. Accounts Receivable, Net**

The following table presents the detail of accounts receivable as of the dates presented (in thousands):

	<b>December 31,</b>	
	<b>2018</b>	<b>2017</b>
Accounts receivable	\$ 61,134	\$ 51,334
Unbilled accounts receivable	9,787	8,403
Less: allowance for doubtful accounts	(4,838)	(5,341)
<b>Accounts receivable, net</b>	<b>\$ 66,083</b>	<b>\$ 54,396</b>

The following table presents the changes in the allowance for doubtful accounts for the periods presented (in thousands):

	<b>Year Ended December 31,</b>		
	<b>2018</b>	<b>2017</b>	<b>2016</b>
Allowance for doubtful accounts:			
Balance, beginning of period	\$ 5,341	\$ 1,337	\$ 3,378
Additions charged to expense	869	7,349	2,681
Less: write-offs, net of recoveries and other adjustments	(1,372)	(3,345)	(4,722)
<b>Balance, end of period</b>	<b>\$ 4,838</b>	<b>\$ 5,341</b>	<b>\$ 1,337</b>

#### **Note 6. Inventory**

The components of inventory, net of applicable lower of cost or net realizable value write-downs, were as follows for the periods presented (in thousands):

	<b>December 31,</b>	
	<b>2018</b>	<b>2017</b>
Work-in-progress	\$ 45,943	\$ —
Finished goods	116,886	—
<b>Inventory</b>	<b>\$ 162,829</b>	<b>\$ —</b>

We have not recorded any inventory write-downs for the years ended December 31, 2018 and 2017.

#### **Note 7. Contract Cost Assets**

As of December 31, 2018, we had \$45.8 million of contract cost assets. During the year ended December 31, 2018, we recorded no impairment losses to contract cost assets. During the year ended December 31, 2018, we recorded \$36.0 million of amortization expense related to contract cost assets.

**Note 8. Property and Equipment, Net**

The following table presents the detail of property and equipment as of the dates presented (in thousands):

	<b>December 31,</b>	
	<b>2018</b>	<b>2017</b>
Website development costs	\$ 149,891	\$ 130,072
Computer equipment	22,477	30,071
Leasehold improvements	65,012	47,321
Construction-in-progress	29,037	28,150
Office equipment, furniture and fixtures	39,510	22,887
Property and equipment	305,927	258,501
Less: accumulated amortization and depreciation	(170,755)	(146,230)
Property and equipment, net	\$ 135,172	\$ 112,271

We recorded depreciation expense related to property and equipment (other than website development costs) of \$19.5 million, \$15.6 million and \$13.5 million, respectively, during the years ended December 31, 2018, 2017 and 2016.

We capitalized \$34.1 million, \$49.9 million and \$49.5 million, respectively, in website development costs during the years ended December 31, 2018, 2017 and 2016. Amortization expense for website development costs included in technology and development expenses was \$28.6 million, \$40.0 million and \$40.0 million, respectively, for the years ended December 31, 2018, 2017 and 2016.

**Note 9. Acquisitions and Equity Investments*****Acquisition of Mortgage Lenders of America***

On October 31, 2018, Zillow Group's wholly owned subsidiary, ZGM Holdco, Inc., acquired the outstanding equity of Mortgage Lenders of America, L.L.C., a national mortgage lender headquartered in Overland Park, Kansas for approximately \$66.7 million in cash.

Our acquisition of MLOA has been accounted for as a business combination, and assets acquired and liabilities assumed were recorded at their estimated fair values as of October 31, 2018. Goodwill, which represents the expected synergies from combining the acquired assets and the operations of the acquirer, as well as intangible assets that do not qualify for separate recognition, is measured as of the acquisition date as the excess of consideration transferred, which is also measured at fair value, and the net of the fair values of the assets acquired and the liabilities assumed as of the acquisition date. The goodwill recognized in conjunction with this business combination has been allocated to our IMT segment.

The total purchase price has been allocated to the assets acquired and liabilities assumed, including identifiable intangible assets, based on their respective fair values at the acquisition date. Based upon the fair values determined by us, in which we considered or relied in part upon a valuation report of a third-party expert, the total purchase price was allocated as follows (in thousands):



Cash and cash equivalents	\$ 10,796
Restricted cash	753
Mortgage loans available for sale	34,248
Property, plant and equipment	1,315
Intangible assets	2,600
Goodwill	53,831
Other acquired assets	3,079
Accounts payable	(1,953)
Accrued expenses	(2,591)
Warehouse lines of credit	(32,536)
Other assumed liabilities	(2,855)
Total purchase price	<u>\$ 66,687</u>

Acquisition-related costs incurred, which primarily included legal, accounting, regulatory and other external costs directly related to the acquisition, are included within Acquisition-related costs within our consolidated statements of operations and were expensed as incurred.

The results of operations related to the acquisition of MLOA have been included in our consolidated financial statements since the date of acquisition, and are not significant. On an unaudited pro forma basis, revenue would have been approximately 3.0% higher for the year ended December 31, 2018 and 5.0% higher for the year-ended December 31, 2017 if the acquisition would have been consummated as of January 1, 2017. Unaudited pro forma earnings information has not been presented as the effects were not material to our consolidated financial statements.

#### ***Acquisition of New Home Feed***

On September 6, 2017, Zillow, Inc. acquired New Home Feed, Inc. (formerly known as Graphic Language, Inc.), a California corporation which operates the New Home Feed business, pursuant to an Agreement and Plan of Merger for an immaterial amount. New Home Feed is a listing management technology that allows builders to input, manage and syndicate their listings across Zillow Group and partner sites. Our acquisition of New Home Feed has been accounted for as a business combination, and assets acquired and liabilities assumed were recorded at their estimated fair values as of September 6, 2017. We acquired goodwill of \$3.6 million and an identifiable intangible asset of \$1.9 million.

Acquisition-related costs incurred related to the acquisition of New Home Feed, which primarily included legal and accounting fees and other external costs directly related to the acquisition, were expensed as incurred and were not material.

The results of operations related to the acquisition of New Home Feed have been included in our consolidated financial statements since the date of acquisition and are not significant. Pro forma financial information for the acquisition accounted for as a business combination has not been presented, as the effects were not material to our consolidated financial statements.

#### ***Acquisition of Hamptons Real Estate Online***

On January 11, 2017, Zillow, Inc. acquired substantially all of the operating assets of RealNet Solutions, Inc., a New York corporation, RealNetDB, LLC, a New York limited liability company, Hamptons Real Estate Online, Inc., a New York corporation, and HREO.com, LLC, a New York limited liability company (collectively, "HREO"), pursuant to an Asset Purchase Agreement entered into by Zillow, Inc., HREO, each of the equity owners of HREO, and an individual acting as representative of the HREO equity holders. HREO is a Hamptons-focused real estate portal which provides buyers and renters with a specialized search experience and access to the area's most comprehensive for-sale, for-rent, and vacant land listings. HREO's listing entry and distribution software, RealNet and Open RealNet Exchange, provides real estate professionals with tools to manage and market their listings. Our acquisition of HREO has been accounted for as a business combination, and assets acquired and liabilities assumed were recorded at their estimated fair values as of January 11, 2017. We acquired goodwill of \$4.0 million, identifiable intangible assets of \$2.1 million and net liabilities of approximately \$0.1 million.

Acquisition-related costs incurred related to the acquisition of HREO, which primarily included legal and accounting fees and other external costs directly related to the acquisition, were expensed as incurred and were not material.

The results of operations related to the acquisition of HREO have been included in our consolidated financial statements since the date of acquisition and are not significant. Pro forma financial information for the acquisition accounted for as a business combination has not been presented, as the effects were not material to our consolidated financial statements.

#### ***Acquisition of Bridge Interactive Group***

In July 2016, Zillow, Inc., Bridge Interactive Group, LLC, a Georgia limited liability company (“Bridge Interactive”), each of the members of Bridge Interactive, and an individual acting as the seller representative, entered into a Securities Purchase Agreement pursuant to which Zillow, Inc. acquired all of the outstanding ownership interests of Bridge Interactive on August 1, 2016. Bridge Interactive is a creator of broker and multiple listing service (MLS) back-office software. Our acquisition of Bridge Interactive has been accounted for as a business combination, and assets acquired and liabilities assumed were recorded at their estimated fair values as of August 1, 2016.

Acquisition-related costs incurred, which primarily included legal and accounting fees and other external costs directly related to the acquisition, were expensed as incurred and were not material.

The results of operations related to the acquisition of Bridge Interactive have been included in our consolidated financial statements since the date of acquisition and are not significant. Pro forma financial information for the acquisition accounted for as a business combination has not been presented, as the effects were not material to our consolidated financial statements.

#### ***Acquisition of Naked Apartments***

In February 2016, Zillow, Inc., Nectarine Merger Sub, Inc., a Delaware corporation and wholly owned subsidiary of Zillow, Inc. (“Merger Sub”), Naked Apartments, Inc., a Delaware corporation (“Naked Apartments”), and an individual acting as the stockholder representative, entered into an Agreement and Plan of Merger (the “Naked Apartments Merger Agreement”), pursuant to which Zillow, Inc. acquired Naked Apartments on February 22, 2016 for approximately \$13.2 million in cash. Under the terms and subject to the conditions of the Naked Apartments Merger Agreement, Merger Sub merged with and into Naked Apartments, with Naked Apartments remaining as the surviving company and a wholly owned subsidiary of Zillow, Inc. Naked Apartments is New York City’s largest rentals-only platform.

Our acquisition of Naked Apartments has been accounted for as a business combination, and assets acquired and liabilities assumed were recorded at their estimated fair values as of February 22, 2016. Goodwill, which represents the expected synergies from combining the acquired assets and the operations of the acquirer, as well as intangible assets that do not qualify for separate recognition, is measured as of the acquisition date as the excess of consideration transferred, which is also measured at fair value, and the net of the fair values of the assets acquired and the liabilities assumed as of the acquisition date.

The total purchase price has been allocated to the assets acquired and liabilities assumed, including identifiable intangible assets, based on their respective fair values at the acquisition date. Based upon the fair values determined by us, in which we considered or relied in part upon a valuation report of a third-party expert, the total purchase price was allocated as follows (in thousands):

Current assets	\$	371
Identifiable intangible assets		3,700
Goodwill		10,610
Current liabilities		(101)
Deferred tax liabilities		(1,416)
Total purchase price	\$	<u>13,164</u>

Acquisition-related costs incurred, which primarily included legal and accounting fees and other external costs directly related to the acquisition, were expensed as incurred and were not material.

The results of operations related to the acquisition of Naked Apartments have been included in our consolidated financial statements since the date of acquisition and are not significant. Pro forma financial information for the acquisition accounted for as a business combination has not been presented, as the effects were not material to our consolidated financial statements.

### ***Equity Investments***

In June 2017, we purchased an equity interest in a privately held corporation for approximately \$10.0 million.

In October 2016, we purchased a 10% equity interest in a privately held variable interest entity within the real estate industry for \$10.0 million. The entity is financed through its business operations. We are not the primary beneficiary of the entity, as we do not direct the activities that most significantly impact the entity's economic performance. Therefore, we do not consolidate the entity. Our maximum exposure to loss is \$10.0 million, the carrying amount of the investment as of December 31, 2018.

These investments are equity securities without readily determinable fair values which we account for at cost minus any impairment, plus or minus changes resulting from observable price changes in orderly transactions for identical or similar investments of the same issuer. During the year ended December 31, 2018, we recognized a non-cash impairment charge of \$10.0 million related to our June 2017 investment. The impairment charge is included in Impairment costs within our consolidated statements of operations. During the third quarter of 2018, in connection with our quarterly qualitative assessment of this investment for impairment indicators, we identified factors that led us to conclude that the investment was impaired and the fair value of the investment was less than the carrying value. The most significant of such factors was related to the business prospects of the investee. Accordingly, we performed an analysis to determine the fair value of the investment and concluded that our best estimate of its fair value was \$0.0 million. This is considered a Level 3 measurement under the fair value hierarchy.

There has been no impairment or upward or downward adjustments for our October 2016 equity investment as of December 31, 2018 that would impact the carrying amount of the investment. The October 2016 investment is classified within other assets in the consolidated balance sheet.

### **Note 10. Goodwill**

The goodwill balance as of December 31, 2018 and 2017 is fully attributable to our IMT segment. The following table presents the change in goodwill from December 31, 2017 through December 31, 2018 (in thousands):

Balance as of December 31, 2017	\$	1,931,076
Goodwill recorded in connection with acquisition of MLOA		53,831
Balance as of December 31, 2018	\$	<u>1,984,907</u>

The goodwill recorded in connection with the acquisition of MLOA, which includes intangible assets that do not qualify for separate recognition, is not deductible for tax purposes.

**Note 11. Intangible Assets**

The following tables present the detail of intangible assets subject to amortization as of the dates presented (in thousands):

<b>December 31, 2018</b>			
	<b>Cost</b>	<b>Accumulated Amortization</b>	<b>Net</b>
Purchased content	\$ 42,110	\$ (30,477)	\$ 11,633
Software	24,296	(13,925)	10,371
Customer relationships	103,900	(60,733)	43,167
Developed technology	111,980	(72,788)	39,192
Trade names and trademarks	4,900	(4,683)	217
MLOA lender licenses	400	(17)	383
Intangibles-in-progress	2,941	—	2,941
Total	<u>\$ 290,527</u>	<u>\$ (182,623)</u>	<u>\$ 107,904</u>

<b>December 31, 2017</b>			
	<b>Cost</b>	<b>Accumulated Amortization</b>	<b>Net</b>
Purchased content	\$ 35,260	\$ (20,480)	\$ 14,780
Software	18,957	(8,899)	10,058
Customer relationships	103,900	(46,365)	57,535
Developed technology	113,380	(56,664)	56,716
Trade names and trademarks	4,900	(3,943)	957
Advertising relationships	9,000	(8,525)	475
Intangibles-in-progress	2,190	—	2,190
Total	<u>\$ 287,587</u>	<u>\$ (144,876)</u>	<u>\$ 142,711</u>

Amortization expense recorded for intangible assets for the years ended December 31, 2018, 2017 and 2016 was \$50.8 million, \$54.3 million and \$47.0 million, respectively, and these amounts are included in technology and development expenses.

Estimated future amortization expense for intangible assets, including amortization related to future commitments (see Note 19), as of December 31, 2018 is as follows (in thousands):

2019	\$	42,648
2020		39,420
2021		33,908
2022		5,480
2023		373
Total future amortization expense	<u>\$</u>	<u>121,829</u>

We have an indefinite-lived intangible asset that we recorded in connection with our February 2015 acquisition of Trulia for Trulia's trade names and trademarks that is not subject to amortization. The carrying value of the Trulia trade names and trademarks intangible asset was \$108.0 million and \$177.0 million, respectively, as of December 31, 2018 and 2017.

During the year ended December 31, 2018, we recognized a non-cash impairment charge of \$69.0 million related to our indefinite-lived Trulia trade names and trademarks intangible asset. The impairment charge is included in Impairment costs within our IMT segment. In connection with our annual budgeting process that was substantially completed during the three months ended December 31, 2018, we identified factors that led us to conclude it was more likely than not that the \$177.0 million carrying value of the asset exceeded its fair value. The most significant of such factors was a shortfall in projected

revenue related to the Trulia brand compared to projections at the time the intangible asset was remeasured as of October 1, 2017. Accordingly, with the assistance of a third-party valuation specialist, we performed a quantitative analysis to determine the fair value of the intangible asset and concluded that our best estimate of its fair value was \$108.0 million. The valuation was prepared using an income approach based on the relief-from-royalty method and relied on inputs with unobservable market prices including the assumed revenue growth rates, royalty rate, discount rate, and estimated tax rate, and therefore is considered a Level 3 measurement under the fair value hierarchy. In connection with this impairment analysis, we evaluated our planned future use of the Trulia trade names and trademarks intangible asset and concluded that it remains appropriate to consider this asset to have an indefinite life.

During the year ended December 31, 2017, we recognized a non-cash impairment charge of \$174.0 million related to our indefinite-lived Trulia trade names and trademarks intangible asset. The impairment charge is included in Impairment costs within our consolidated statements of operations. In connection with our qualitative assessment of the recoverability of this asset during our annual impairment test as of October 1, 2017, we identified factors that led us to conclude it was more likely than not that the \$351.0 million carrying value of the asset exceeded its fair value. The most significant of such factors was a shortfall in projected revenue related to the Trulia brand compared to projections at the time the intangible asset was initially recorded in February 2015. Accordingly, with the assistance of a third-party valuation specialist, we performed a quantitative analysis to determine the fair value of the intangible asset and concluded that our best estimate of its fair value was \$177.0 million. The valuation was prepared using an income approach based on the relief-from-royalty method and relied on inputs with unobservable market prices including the assumed revenue growth rates, royalty rate, discount rate, and estimated tax rate, and therefore is considered a Level 3 measurement under the fair value hierarchy. In connection with this impairment analysis, we evaluated our planned future use of the Trulia trade names and trademarks intangible asset and concluded that it remains appropriate to consider this asset to have an indefinite life.

#### **Note 12. Accrued Expenses and Other Current Liabilities**

The following table presents the detail of accrued expenses and other current liabilities as of the dates presented (in thousands):

	<b>December 31,</b>	
	<b>2018</b>	<b>2017</b>
Accrued marketing and advertising	\$ 18,559	\$ 17,180
Accrued purchased content	4,256	5,984
Accrued estimated legal liabilities and legal fees	7,305	9,052
Merger consideration payable to former stockholders of certain acquired entities	5,904	5,904
Other accrued expenses and other current liabilities	27,077	23,253
Total accrued expenses and other current liabilities	<u>\$ 63,101</u>	<u>\$ 61,373</u>

#### **Note 13. Deferred Revenue**

The following table presents the change in deferred revenue for the period presented (in thousands):

	<b>Year Ended December 31, 2018</b>
Balance as of January 1, 2018	\$ 31,918
Deferral of revenue	982,647
Less: Revenue recognized	(980,485)
Balance as of December 31, 2018	<u>\$ 34,080</u>

During the year ended December 31, 2018, we recognized as revenue a total of \$28.8 million pertaining to amounts that were recorded in deferred revenue as of December 31, 2017.

**Note 14. Debt*****Revolving Credit Facility***

On July 31, 2018, certain wholly owned subsidiaries of Zillow Group entered into a revolving credit agreement with Credit Suisse AG, Cayman Islands Branch, as the directing lender, and certain other parties thereto (the “Revolving Credit Facility”). The Revolving Credit Facility initially provided for a maximum borrowing capacity of \$250.0 million, and this borrowing capacity was increased to \$500.0 million effective December 31, 2018 (the “Maximum Amount”) and has a current borrowing capacity of \$126.7 million as of December 31, 2018, which amount may be increased up to the Maximum Amount subject to the satisfaction of certain conditions, through a non-recourse credit facility secured by a pledge of the equity of certain Zillow Group subsidiaries that purchase and sell select residential properties through Zillow Offers. In certain circumstances Zillow Group may be obligated to fund some or all of the payment obligations under the Revolving Credit Facility. Zillow Group formed certain special purpose entities to effectuate the transactions contemplated by the agreement underlying the Revolving Credit Facility. Each special purpose entity is a wholly owned subsidiary of Zillow Group and a separate legal entity, and neither the assets nor credit of any such entity are available to satisfy the debts and other obligations of any affiliate or other entity.

The Revolving Credit Facility has an initial term of one year which may be extended for up to two additional years subject to agreement by the directing lender. The Revolving Credit Facility includes customary representations and warranties, covenants (including financial covenants applicable to Zillow Group), and provisions regarding events of default. As of December 31, 2018, Zillow Group was in compliance with all financial covenants and no event of default had occurred. Availability of funds under the Revolving Credit Facility is limited by a formula equal to the lower of 85% of the aggregate acquisition cost of financed residential properties or 85% of the aggregate market value, which for each residential property is the sum of the value established by an independent broker-pricing opinion and renovation costs paid.

Pursuant to the terms of the Revolving Credit Facility, we are required to establish, maintain, and in certain circumstances fund, certain specified reserve accounts. These reserve accounts include, but are not limited to, interest reserves, insurance, tax reserves, renovation cost reserves and special reserves. The credit facility reserve accounts and the collection account into which funds are deposited upon the resale of financed residential properties, which funds are used to repay amounts borrowed on the Revolving Credit Facility, are under the sole control of Credit Suisse AG, New York Branch, as defined in the agreement governing the Revolving Credit Facility. Amounts funded to these reserve accounts and the collection account have been classified within our consolidated balance sheets as restricted cash. Borrowings on our Revolving Credit Facility bear interest at the one-month London Interbank Offered Rate (“LIBOR”) plus the applicable margin, as defined in the credit agreement governing the Revolving Credit Facility. We are also required to pay a funding fee for each financed residential property and certain other fees to certain other parties to the agreement. Interest, funding fees and other fees, including the amortization of deferred issuance costs, are classified within interest expense in our consolidated statements of operations.

As of December 31, 2018, we have outstanding \$116.7 million of borrowings on the Revolving Credit Facility. The facility has a maximum borrowing capacity of \$500.0 million with a current borrowing capacity of \$126.7 million. Approximately \$383.3 million is available for future borrowings. The weighted average interest rate related to the Revolving Credit Facility from July 31, 2018 through December 31, 2018 was 5.86%.

***Warehouse Lines of Credit***

As part of the acquisition of MLOA, Zillow Group acquired two warehouse lines of credit. Each line of credit provides for a current and maximum borrowing capacity of \$50.0 million, or \$100.0 million in total. The lines of credit mature on July 15, 2019 and March 31, 2019 and include customary representations and warranties, covenants and provisions regarding events of default. As of December 31, 2018, Zillow Group was in compliance with all financial covenants and no event of default had occurred. Availability under the lines of credit is limited depending on the types of loans originated. Borrowings on the lines of credit bear interest at either the one-month LIBOR or the daily adjusting LIBOR, plus an applicable margin, as defined in the credit agreements governing the warehouse lines of credit. The weighted average interest rates on each of the lines of credit from the acquisition of MLOA through December 31, 2018 were 4.88% and 4.73%.



***Convertible Senior Notes due in 2023***

On July 3, 2018, Zillow Group issued \$373.8 million aggregate principal amount of Convertible Senior Notes due 2023 (the “2023 Notes”), which includes \$48.8 million principal amount of 2023 Notes sold pursuant to the underwriters’ option to purchase additional 2023 Notes. The 2023 Notes bear interest at a fixed rate of 1.50% per year, payable semi-annually in arrears on January 1 and July 1 of each year, beginning on January 1, 2019. The 2023 Notes are convertible into cash, shares of Class C capital stock or a combination thereof, at our election. The 2023 Notes will mature on July 1, 2023, unless earlier repurchased, redeemed, or converted in accordance with their terms.

The net proceeds from the issuance of the 2023 Notes were approximately \$364.0 million, after deducting underwriting discounts and commissions and offering expenses payable by the Company. We used approximately \$29.4 million of the net proceeds from the issuance of the 2023 Notes to pay the cost of the Capped Call Confirmations described below. The Company intends to use the remainder of the net proceeds for general corporate purposes.

Prior to the close of business on the business day immediately preceding April 1, 2023, the 2023 Notes are convertible at the option of the holders only under certain conditions. On or after April 1, 2023, until the close of business on the second scheduled trading day immediately preceding the maturity date, holders may convert their 2023 Notes at their option at the conversion rate then in effect, irrespective of these conditions. The Company may settle conversions of the 2023 Notes by paying or delivering, as the case may be, cash, shares of the Company’s Class C capital stock, or a combination of cash and shares of Class C capital stock, at its election. The conversion rate will initially be 12.7592 shares of Class C capital stock per \$1,000 principal amount of 2023 Notes (equivalent to an initial conversion price of approximately \$78.37 per share of Class C capital stock). The conversion rate is subject to customary adjustments upon the occurrence of certain events. The Company may redeem for cash all or part of the 2023 Notes, at its option, on or after July 6, 2021, under certain circumstances at a redemption price equal to 100% of the principal amount of the 2023 Notes to be redeemed, plus accrued and unpaid interest to, but excluding, the redemption date (as defined in the indenture governing the 2023 Notes). The conversion option does not meet the criteria for separate accounting as a derivative as it is indexed to our own stock.

If the Company undergoes a fundamental change (as defined in the indenture governing the 2023 Notes), holders may require the Company to repurchase for cash all or part of their 2023 Notes at a repurchase price equal to 100% of the principal amount of the 2023 Notes to be repurchased, plus accrued and unpaid interest to, but excluding, the fundamental change repurchase date (as defined in the indenture governing the 2023 Notes). In addition, if certain fundamental changes occur, the Company may be required in certain circumstances to increase the conversion rate for any Notes converted in connection with such fundamental changes by a specified number of shares of its Class C capital stock. Certain events are also considered “Events of Default,” which may result in the acceleration of the maturity of the 2023 Notes, as described in the indenture governing the 2023 Notes. There are no financial covenants associated with the 2023 Notes.

We may not redeem the 2023 Notes prior to July 6, 2021. We may redeem for cash all or any portion of the 2023 Notes, at our option, in whole or in part on or after July 6, 2021 if the last reported sale price per share of our Class C capital stock has been at least 130% of the conversion price then in effect for at least 20 trading days (whether or not consecutive) during any 30 consecutive trading day period.

In accounting for the issuance of the 2023 Notes, the Company separated the 2023 Notes into liability and equity components. The carrying amount of the liability component was calculated by measuring the fair value of a similar liability that does not have an associated convertible feature. The carrying amount of the equity component, representing the conversion option, was determined by deducting the fair value of the liability component from the par value of the 2023 Notes. The difference between the principal amount of the 2023 Notes and the liability component represents the debt discount, which is recorded as a direct deduction from the related debt liability in the consolidated balance sheet and amortized to interest expense using the effective interest method over the term of the 2023 Notes. The equity component of the 2023 Notes of approximately \$78.6 million is included in additional paid-in capital in the consolidated balance sheet and is not remeasured as long as it continues to meet the conditions for equity classification.

Interest expense related to the 2023 Notes for the year ended December 31, 2018 was \$10.1 million, which is comprised of approximately \$7.3 million related to the amortization of debt discount and debt issuance costs and \$2.8 million for the contractual coupon interest.

The effective interest rate on the liability component of the 2023 Notes for the year ended December 31, 2018 is 6.99%. Accrued interest related to the 2023 Notes as of December 31, 2018 was not material. Accrued interest is recorded in accrued expenses and other current liabilities in our consolidated balance sheet.

The following table presents the outstanding principal amount and carrying value of the 2023 Notes as of the date presented (in thousands):

	<b>Outstanding Principal Amount</b>	<b>Unamortized Debt Discount and Debt Issuance Costs</b>	<b>Carrying Value</b>
December 31, 2018	\$ 373,750	\$ (79,012)	\$ 294,738

As of December 31, 2018, the unamortized debt discount and debt issuance costs for the 2023 Notes will be amortized to interest expense over a remaining period of approximately 54 months.

The estimated fair value of the 2023 Notes was \$321.9 million as of December 31, 2018. The estimated fair value of the 2023 Notes was determined through consideration of quoted market prices. The fair value is classified as Level 3 due to the limited trading activity for the 2023 Notes.

The Capped Call Confirmations are expected generally to reduce the potential dilution of our Class C capital stock upon any conversion of 2023 Notes and/or offset the cash payments the Company is required to make in excess of the principal amount of the 2023 Notes in the event that the market price of the Class C capital stock is greater than the strike price of the Capped Call Confirmations (which initially corresponds to the initial conversion price of the 2023 Notes and is subject to certain adjustments under the terms of the Capped Call Confirmations), with such reduction and/or offset subject to a cap based on the cap price of the Capped Call Confirmations. The Capped Call Confirmations have an initial cap price of \$105.45 per share, which represents a premium of approximately 85% over the public offering price of the Company's Class C capital stock in the concurrent share offering of \$57.00, and is subject to certain adjustments under the terms of the Capped Call Confirmations. The Capped Call Confirmations will cover, subject to anti-dilution adjustments substantially similar to the 2023 Notes, the number of shares of Class C capital stock that will underlie the 2023 Notes. The Capped Call Confirmations do not meet the criteria for separate accounting as a derivative as they are indexed to our own stock. The premiums paid for the Capped Call Confirmations have been included as a net reduction to additional paid-in-capital within shareholders' equity.

### ***Convertible Senior Notes due in 2021***

On December 12, 2016, Zillow Group issued \$460.0 million aggregate principal amount of 2.00% Convertible Senior Notes due 2021 (the "2021 Notes"), which amount includes the exercise in full of the \$60.0 million over-allotment option, to Citigroup Global Markets Inc. as the initial purchaser of the 2021 Notes in a private offering to the initial purchaser in reliance on the exemption from the registration requirements provided by Section 4(a)(2) of the Securities Act of 1933, as amended (the "Securities Act") for resale to qualified institutional buyers as defined in, and pursuant to, Rule 144A under the Securities Act. The 2021 Notes bear interest at a fixed rate of 2.00% per year, payable semi-annually in arrears on June 1 and December 1 of each year. The 2021 Notes are convertible into cash, shares of our Class C capital stock or a combination thereof, at the Company's election. The 2021 Notes will mature on December 1, 2021, unless earlier repurchased, redeemed, or converted in accordance with their terms.

The net proceeds from the issuance of the 2021 Notes were approximately \$447.8 million, after deducting fees and expenses. The Company used approximately \$370.2 million of the net proceeds from the issuance of the 2021 Notes to repurchase a portion of the outstanding 2020 Notes (see additional information below under "Trulia's Convertible Senior Notes due 2020") in privately negotiated transactions. In addition, the Company used approximately \$36.6 million of the net proceeds

from the issuance of the 2021 Notes to pay the cost of the capped call transactions with the initial purchaser of the 2021 Notes and two additional financial institutions (“Capped Call Confirmations”) as discussed further below. The Company used the remainder of the net proceeds for general corporate purposes.

Prior to the close of business on the business day immediately preceding September 1, 2021, the 2021 Notes are convertible at the option of the holders of the 2021 Notes only under certain conditions, none of which conditions have been satisfied as of December 31, 2018. On or after September 1, 2021, until the close of business on the second scheduled trading day immediately preceding the maturity date, holders of the 2021 Notes may convert their 2021 Notes at their option at the conversion rate then in effect, irrespective of these conditions. The Company may settle conversions of the 2021 Notes by paying or delivering, as the case may be, cash, shares of Class C capital stock, or a combination of cash and shares of Class C capital stock, at its election. The conversion rate will initially be 19.0985 shares of Class C capital stock per \$1,000 principal amount of 2021 Notes (equivalent to an initial conversion price of approximately \$52.36 per share of Class C capital stock). The conversion rate is subject to customary adjustments upon the occurrence of certain events. The Company may redeem for cash all or part of the 2021 Notes, at its option, on or after December 6, 2019, under certain circumstances at a redemption price equal to 100% of the principal amount of the 2021 Notes to be redeemed, plus accrued and unpaid interest to, but excluding, the redemption date (as defined in the indenture governing the 2021 Notes). The conversion option does not meet the criteria for separate accounting as a derivative as it is indexed to our own stock.

If the Company undergoes a fundamental change (as defined in the indenture governing the 2021 Notes), holders of the 2021 Notes may require the Company to repurchase for cash all or part of their 2021 Notes at a repurchase price equal to 100% of the principal amount of the 2021 Notes to be repurchased, plus accrued and unpaid interest to, but excluding, the fundamental change repurchase date (as defined in the indenture governing the 2021 Notes). In addition, if certain fundamental changes occur, the Company may be required in certain circumstances to increase the conversion rate for any 2021 Notes converted in connection with such fundamental changes by a specified number of shares of its Class C capital stock. Certain events are also considered “Events of Default,” which may result in the acceleration of the maturity of the 2021 Notes, as described in the indenture governing the notes. There are no financial covenants associated with the 2021 Notes.

We may not redeem the 2021 Notes prior to December 6, 2019. We may redeem the 2021 Notes for cash, at our option, in whole or in part on or after December 6, 2019, if the last reported sale price per share of our Class C capital stock has been at least 130% of the conversion price then in effect for at least 20 trading days (whether or not consecutive) during any 30 consecutive trading day period.

In accounting for the issuance of the 2021 Notes, the Company separated the 2021 Notes into liability and equity components. The carrying amount of the liability component was calculated by measuring the fair value of a similar liability that does not have an associated conversion feature. The carrying amount of the equity component, representing the conversion option, was determined by deducting the fair value of the liability component from the par value of the 2021 Notes. The difference between the principal amount of the 2021 Notes and the liability component represents the debt discount, which is recorded as a direct deduction from the related debt liability in the consolidated balance sheet and amortized to interest expense using the effective interest method over the term of the 2021 Notes. The equity component of the 2021 Notes of approximately \$91.4 million is included in additional paid-in capital in the consolidated balance sheet and is not remeasured as long as it continues to meet the conditions for equity classification.

The Company incurred transaction costs of approximately \$12.2 million related to the issuance of the 2021 Notes, including approximately \$11.5 million in fees to the initial purchaser, which amount was paid out of the gross proceeds from the note offering. In accounting for the transaction costs, the Company allocated the total amount incurred to the liability and equity components using the same proportions as the proceeds from the 2021 Notes. Transaction costs attributable to the liability component were recorded as a direct deduction from the related debt liability in the consolidated balance sheet and amortized to interest expense over the term of the 2021 Notes, and transaction costs attributable to the equity component were netted with the equity component in shareholders’ equity.

Interest expense related to the 2021 Notes for the year ended December 31, 2018 was \$28.6 million, which is comprised of approximately \$19.4 million related to the amortization of debt discount and debt issuance costs and \$9.2 million for the

contractual coupon interest. Interest expense related to the 2021 Notes for the year ended December 31, 2017 was \$27.2 million, which is comprised of approximately \$18.0 million related to the amortization of debt discount and debt issuance costs and \$9.2 million for the contractual coupon interest. Interest expense related to the 2021 Notes for the year ended December 31, 2016 was \$1.3 million, which is comprised of approximately \$0.9 million related to the amortization of debt discount and debt issuance costs and \$0.5 million for the contractual coupon interest. The effective interest rate on the liability component of the 2021 Notes is 7.44% for the years ended December 31, 2018, 2017 and 2016. Accrued interest related to the 2021 Notes was \$0.8 million as of December 31, 2018 and 2017 and is recorded in accrued expenses and other current liabilities in the consolidated balance sheet.

The following table presents the outstanding principal amount and carrying value of the 2021 Notes as of the dates presented (in thousands):

	<b>Outstanding Principal Amount</b>	<b>Unamortized Debt Discount and Debt Issuance Costs</b>	<b>Carrying Value</b>
December 31, 2018	\$ 460,000	\$ (65,355)	\$ 394,645
December 31, 2017	\$ 460,000	\$ (84,721)	\$ 375,279

As of December 31, 2018, the unamortized debt discount and debt issuance costs for the 2021 Notes will be amortized to interest expense over a remaining period of approximately 35 months.

The estimated fair value of the 2021 Notes was \$446.2 million and \$509.0 million, respectively, as of December 31, 2018 and 2017. The estimated fair value of the 2021 Notes was determined through consideration of quoted market prices. The fair value is classified as Level 3 due to the limited trading activity for the 2021 Notes.

The Capped Call Confirmations are expected generally to reduce the potential dilution of our Class C capital stock upon any conversion of 2021 Notes and/or offset the cash payments the Company is required to make in excess of the principal amount of the 2021 Notes in the event that the market price of the Class C capital stock is greater than the strike price of the Capped Call Confirmations (which initially corresponds to the initial conversion price of the 2021 Notes and is subject to certain adjustments under the terms of the Capped Call Confirmations), with such reduction and/or offset subject to a cap based on the cap price of the Capped Call Confirmations. The Capped Call Confirmations have an initial cap price of \$69.19 per share, which represents a premium of approximately 85% over the closing price of the Company's Class C capital stock on The Nasdaq Global Select Market on December 6, 2016, and is subject to certain adjustments under the terms of the Capped Call Confirmations. The Capped Call Confirmations will cover, subject to anti-dilution adjustments substantially similar to those applicable to the 2021 Notes, the number of shares of Class C capital stock that will underlie the 2021 Notes. In addition, the Capped Call Confirmations provide for the Company to elect, subject to certain conditions, for the Capped Call Confirmations to remain outstanding (with certain modifications) following its election to redeem the 2021 Notes, notwithstanding any conversions of 2021 Notes in connection with such redemption. The Capped Call Confirmations do not meet the criteria for separate accounting as a derivative as they are indexed to our own stock. The premiums paid for the Capped Call Confirmations have been included as a net reduction to additional paid-in capital within shareholders' equity.

### ***Trulia's Convertible Senior Notes due in 2020***

In connection with the February 2015 acquisition of Trulia, a portion of the total purchase price was allocated to Trulia's Convertible Senior Notes due in 2020 (the "2020 Notes"), which are unsecured senior obligations. Pursuant to and in accordance with the Merger Agreement, Zillow Group entered into a supplemental indenture in respect of the 2020 Notes in the aggregate principal amount of \$230.0 million, which supplemental indenture provides, among other things, that, at the effective time of the Trulia Merger, (i) each outstanding 2020 Note is no longer convertible into shares of Trulia common stock and is convertible solely into shares of Zillow Group Class A common stock, pursuant to, and in accordance with, the terms of the indenture governing the 2020 Notes, and (ii) Zillow Group guaranteed all of the obligations of Trulia under the 2020 Notes and related indenture. In December 2016, the Company used approximately \$370.2 million of the net proceeds from the issuance of the 2021 Notes discussed above to repurchase \$219.9 million aggregate principal of the 2020 Notes in privately negotiated

transactions. The aggregate principal amount of the 2020 Notes is due on December 15, 2020 if not earlier converted or redeemed. Interest is payable on the 2020 Notes at the rate of 2.75% semi-annually on June 15 and December 15 of each year.

Holders of the 2020 Notes may convert all or any portion of their notes, in multiples of \$1,000 principal amount, at their option at any time prior to the close of business on the business day immediately preceding the maturity date. Regarding the supplemental indenture in respect of the 2020 Notes, the conversion ratio immediately prior to the effective time of the Trulia Merger of 27.8303 shares of Trulia common stock per \$1,000 principal amount of notes was adjusted to 12.3567 shares of our Class A common stock per \$1,000 principal amount of notes based on the exchange ratio of 0.444 per the Merger Agreement. This was equivalent to an initial conversion price of approximately \$80.93 per share of our Class A common stock. Regarding the August 2015 distribution of shares of our Class C capital stock as a dividend to our Class A and Class B common shareholders, the conversion ratio has been further adjusted to 41.4550 shares of Class A common stock per \$1,000 principal amount of notes, which is equivalent to a conversion price of approximately \$24.12 per share of our Class A common stock. The conversion ratio will be adjusted for certain dilutive events and will be increased in the case of corporate events that constitute a “Make-Whole Fundamental Change” (as defined in the indenture governing the notes). The conversion option of the 2020 Notes has no cash settlement provisions. The conversion option does not meet the criteria for separate accounting as a derivative as it is indexed to our own stock.

The holders of the 2020 Notes will have the ability to require us to repurchase the notes in whole or in part upon the occurrence of an event that constitutes a “Fundamental Change” (as defined in the indenture governing the notes, including such events as a “change in control” or “termination of trading”, subject to certain exceptions). In such case, the repurchase price would be 100% of the principal amount of the 2020 Notes plus accrued and unpaid interest, if any, to, but excluding, the Fundamental Change repurchase date. Certain events are also considered “Events of Default,” which may result in the acceleration of the maturity of the 2020 Notes, as described in the indenture governing the notes. There are no financial covenants associated with the 2020 Notes.

The 2020 Notes are redeemable, at our option, in whole or in part as of December 20, 2018, if the last reported sale price per share of our Class A common stock has been at least 130% of the conversion price then in effect for at least 20 trading days (whether or not consecutive) during any 30 consecutive trading day period.

Interest expense related to the 2020 Notes for the years ended December 31, 2018 and 2017 was \$0.3 million, and for the year ended December 31, 2016 was \$6.1 million. Accrued interest related to the 2020 Notes as of December 31, 2018 and 2017 was not material. Accrued interest is recorded in accrued expenses and other current liabilities in our consolidated balance sheet.

The carrying value of the 2020 Notes was \$9.6 million and \$10.1 million, respectively, as of December 31, 2018 and 2017. The estimated fair value of the 2020 Notes was \$16.7 million and \$17.6 million, respectively, as of December 31, 2018 and 2017. The estimated fair value of the 2020 Notes was determined through consideration of quoted market prices. The fair value is classified as Level 3 due to the limited trading activity for the 2020 Notes.

#### **Note 15. Income Taxes**

We are subject to federal and state income taxes in the United States and in Canada. For the years ended December 31, 2018, 2017 and 2016, we did not have a material amount of current taxable income.

We recorded an income tax benefit of \$31.1 million for the year ended December 31, 2018. Approximately \$15.4 million of the income tax benefit relates to a \$69.0 million non-cash impairment we recorded during the year ended December 31, 2018 related to the indefinite-lived Trulia trade names and trademarks intangible asset. The remaining portion of our income tax benefit is primarily the result of net operating losses generated after December 31, 2017 with an indefinite carryforward period due to the Tax Act. Current year net operating losses can now offset against the indefinite-lived deferred tax liabilities which resulted in a release of the valuation allowance and a resulting income tax benefit.



During the year ended December 31, 2018, we completed our accounting for the income tax effects related to the deduction limitations on compensation under the Tax Act. The Internal Revenue Service provided further guidance in applying the written binding contracts requirement under the Tax Act, and we believe certain of our executive compensation previously eligible to be deductible for tax purposes under Section 162(m) of the Internal Revenue Code will be considered grandfathered and, therefore, will continue to be deductible. Based on the clarification of these rules, the accounting related to the Section 162(m) limitation of the Internal Revenue Code is considered complete and as a result we recorded a \$5.9 million tax benefit for the year ended December 31, 2018.

We recorded an income tax benefit of \$89.6 million for the year ended December 31, 2017. Approximately \$66.0 million of the income tax benefit relates to a \$174.0 million non-cash impairment we recorded during the year ended December 31, 2017 related to the \$351.0 million indefinite-lived intangible asset that we recorded in connection with our February 2015 acquisition of Trulia for Trulia's trade names and trademarks. For additional information about the non-cash impairment, see Note 11 to our consolidated financial statements. The remaining \$23.6 million of the income tax benefit primarily relates to our initial analysis of the impact of the rate decrease included in the Tax Act for the impact of the reduction in our net deferred tax liability related to our indefinite-lived intangible asset.

The following table summarizes the components of our income tax (benefit) expense for the periods presented (in thousands):

	Year Ended December 31,		
	2018	2017	2016
Current income tax expense			
Foreign	\$ 161	\$ —	\$ —
Total current income tax expense	161	—	—
Deferred income tax (benefit) expense			
Federal	(28,502)	(84,238)	(1,248)
State	(2,441)	(5,348)	1,378
Foreign	(320)	—	—
Total deferred income tax (benefit) expense	(31,263)	(89,586)	130
Total income tax (benefit) expense	<u>\$ (31,102)</u>	<u>\$ (89,586)</u>	<u>\$ 130</u>

The following table presents a reconciliation of the federal statutory rate and our effective tax rate for the periods presented:

	Year Ended December 31,		
	2018	2017	2016
Tax expense at federal statutory rate	(21.0)%	(35.0)%	(35.0)%
State income taxes, net of federal tax benefit	(5.9)	(4.4)	(1.9)
Nondeductible expenses	—	0.8	4.9
Share-based compensation	(16.5)	(20.6)	(0.2)
IRC section 162(m)	1.0	—	—
Research and development credits	(8.4)	(6.3)	(1.5)
Meals and entertainment	1.8	—	—
Return to provision adjustments	(4.2)	—	—
Enactment of Tax Act	(1.9)	(13.1)	—
Other	0.4	2.2	(0.9)
Valuation allowance	34.0	27.7	34.7
Effective tax rate	<u>(20.7)%</u>	<u>(48.7)%</u>	<u>0.1 %</u>

Deferred federal, state and foreign income taxes reflect the net tax impact of temporary differences between the carrying amounts of assets and liabilities for financial reporting purposes and such amounts for tax purposes. The following table presents the significant components of our deferred tax assets and liabilities as of the dates presented (in thousands):



	December 31,	
	2018	2017
Deferred tax assets:		
Federal and state net operating loss carryforwards	\$ 259,629	\$ 234,316
Share-based compensation	55,280	47,655
Start-up and organizational costs	99	146
Research and development credits	48,805	35,793
Other tax credits	910	910
Accruals and reserves	3,000	2,729
Deferred rent	4,842	5,484
Other deferred tax assets	14,267	8,342
Total deferred tax assets	386,832	335,375
Deferred tax liabilities:		
Website and software development costs	(14,685)	(13,202)
Goodwill	(598)	(688)
Intangible assets	(45,035)	(69,241)
Discount on 2021 Notes and 2023 Notes not deductible for tax	(31,450)	(19,374)
Depreciation and amortization	(888)	(2,425)
Total deferred tax liabilities	(92,656)	(104,930)
Net deferred tax assets before valuation allowance	294,176	230,445
Less: valuation allowance	(307,599)	(274,810)
Net deferred tax liabilities	<u>\$ (13,423)</u>	<u>\$ (44,365)</u>

Realization of deferred tax assets is dependent upon the generation of future taxable income, if any, the timing and amount of which are uncertain. We have provided a full valuation allowance against the net deferred tax assets as of December 31, 2018 and 2017 because, based on the weight of available evidence, it is more likely than not (a likelihood of more than 50%) that some or all of the deferred tax assets will not be realized. The valuation allowance increased by \$32.8 million and \$57.5 million, respectively, during the years ended December 31, 2018 and 2017.

We have accumulated federal tax losses of approximately \$1,081.7 million and \$1,014.0 million, respectively, as of December 31, 2018 and 2017, which are available to reduce future taxable income. We have accumulated state tax losses of approximately \$32.5 million and \$21.4 million (tax effected), respectively, as of December 31, 2018 and 2017. Additionally, we have net research and development credit carryforwards of \$48.8 million and \$35.8 million, respectively, as of December 31, 2018 and 2017, which are available to reduce future tax liabilities. The tax loss and research and development credit carryforwards begin to expire in 2025. Under Sections 382 and 383 of the Internal Revenue Code, if a corporation undergoes an ownership change, the corporation's ability to use its pre-change net operating loss carryforwards and other pre-change tax attributes, such as research tax credits, to offset its post-change income or income tax liability may be limited. In connection with our August 2013 public offering of our Class A Common stock, we experienced an ownership change that triggered Sections 382 and 383, which may limit our ability to utilize net operating loss and tax credit carryforwards. In connection with our February 2015 acquisition of Trulia, Trulia experienced an ownership change that triggered Section 382 and 383, which may limit Zillow Group's ability to utilize Trulia's net operating loss and tax credit carryforwards.

We are currently not under audit in any tax jurisdiction. Tax years from 2015 through 2018 are currently open for audit by federal and state taxing authorities.

Changes for unrecognized tax benefits for the periods presented are as follows (in thousands):

Balance at January 1, 2016	\$	13,980
Gross increases—prior and current period tax positions		2,619
Gross decreases—prior period tax positions		(1,204)
Balance at December 31, 2016	\$	15,395
Gross increases—current period tax positions		5,216
Gross increases—prior period tax positions		1,002
Balance at December 31, 2017	\$	21,613
Gross increases—current period tax positions		6,421
Gross increases—prior period tax positions		591
Balance at December 31, 2018	\$	28,625

At December 31, 2018, the total amount of unrecognized tax benefits of \$28.6 million is recorded as a reduction to our deferred tax asset. We do not anticipate that the amount of existing unrecognized tax benefits will significantly increase or decrease within the next 12 months. Accrued interest and penalties related to unrecognized tax benefits are recorded as income tax expense and are zero.

## **Note 16. Shareholders' Equity**

### ***Preferred Stock***

Our board of directors has the authority to fix and determine and to amend the number of shares of any series of preferred stock that is wholly unissued or to be established and to fix and determine and to amend the designation, preferences, voting powers and limitations, and the relative, participating, optional or other rights, of any series of shares of preferred stock that is wholly unissued or to be established, subject in each case to certain approval rights of holders of our outstanding Class B common stock. There was no preferred stock issued and outstanding as of December 31, 2018 or December 31, 2017.

### ***Common and Capital Stock***

Our Class A common stock has no preferences or privileges and is not redeemable. Holders of Class A common stock are entitled to one vote for each share.

Our Class B common stock has no preferences or privileges and is not redeemable. At any time after the date of issuance, each share of Class B common stock, at the option of the holder, may be converted into one share of Class A common stock, or automatically converted into Class A common stock upon the affirmative vote by or written consent of holders of a majority of the shares of the Class B common stock. During the years ended December 31, 2018, 2017 and 2016, no shares of Class B common stock were converted into Class A common stock at the option of the holders. Holders of Class B common stock are entitled to 10 votes for each share.

Our Class C capital stock has no preferences or privileges, is not redeemable and, except in limited circumstances, is non-voting. On July 3, 2018, Zillow Group issued and sold 6,557,017 shares (of which 855,263 shares were related to the exercise of the underwriters' option to purchase additional shares) of our Class C capital stock at a public offering price of \$57.00 per share. We received net proceeds of \$360.3 million after deducting underwriting discounts and commissions and offering expenses payable by us.

The following shares of common and capital stock have been reserved for future issuance as of the dates presented:

	December 31, 2018	December 31, 2017
Option awards outstanding	27,310,110	26,645,206
Restricted stock units outstanding	5,266,324	4,016,405
Class A common stock and Class C capital stock available for grant under 2011 Plan	3,675,082	5,076,898
Shares issuable upon conversion of outstanding Class B common stock	6,217,447	6,217,447
Total	42,468,963	41,955,956

#### Note 17. Share-Based Awards

In connection with our February 2015 acquisition of Trulia, we assumed the obligations of Zillow and Trulia outstanding under pre-existing stock plans. We intend that future equity grants will be made under Zillow Group's 2011 Amended and Restated Incentive Plan (as amended and/or restated from time to time, the "2011 Plan") only (or a successor thereto).

##### *Zillow Group, Inc. Amended and Restated 2011 Incentive Plan*

On July 19, 2011, the 2011 Plan became effective. In addition to the share reserve of 18,400,000 shares, the number of shares available for issuance under the 2011 Plan automatically increases on the first day of each of our fiscal years by a number of shares equal to the least of (a) 3.5% of our outstanding Class A common stock, Class B common stock, and Class C capital stock on a fully diluted basis as of the end of our immediately preceding fiscal year, (b) 10,500,000 shares, and (c) a lesser amount determined by our board of directors; provided, however, that any shares from any increases in previous years that are not actually issued will continue to be available for issuance under the 2011 Plan. In addition, shares previously available for grant under Zillow, Inc.'s 2005 Equity Incentive Plan (the "2005 Plan"), but not issued or subject to outstanding awards under the 2005 Plan as of July 19, 2011, and shares subject to outstanding awards under the 2005 Plan that subsequently cease to be subject to such awards (other than by reason of exercise of the awards) are available for grant under the 2011 Plan. The 2011 Plan is administered by the compensation committee of the board of directors. Under the terms of the 2011 Plan, the compensation committee may grant equity awards, including incentive stock options, nonqualified stock options, restricted stock, restricted stock units or restricted units to employees, officers, directors, consultants, agents, advisers and independent contractors. The board of directors has also authorized certain senior executive officers to grant equity awards under the 2011 Plan, within limits prescribed by our board of directors. The 2011 Plan provides that in the event of a stock dividend, stock split or similar event, the maximum number and kind of securities available for issuance under the plan will be proportionally adjusted.

Options under the 2011 Plan are granted with an exercise price per share not less than 100% of the fair market value of our stock on the date of grant, with the exception of substituted option awards granted in connection with acquisitions, and are exercisable at such times and under such conditions as determined by the compensation committee. Any portion of an option that is not vested and exercisable on the date of a participant's termination of service expires on such date. Employees generally forfeit their rights to exercise vested options 3 months following their termination of employment or 12 months following termination by reason of death, disability or retirement. Options granted under the 2011 Plan typically expire seven or ten years from the grant date and typically vest either 25% after 12 months and ratably thereafter over the next 36 months or quarterly over a period of four years, though certain options have been granted with alternative vesting schedules.

Restricted stock units granted under the 2011 Plan typically vest either 25% after 12 months and quarterly thereafter over the next three years, quarterly over a period of four years, or 12.5% after 6 months and quarterly thereafter for the next 3.5 years. Any portion of a restricted stock unit that is not vested on the date of a participant's termination of service expires on such date.

In March 2016, Zillow Group established an equity choice program pursuant to which Zillow Group grants restricted stock units and option awards to acquire shares of Class C capital stock to certain employees to retain and recognize their efforts on behalf of Zillow Group.

**Trulia 2005 Stock Incentive Plan**

Trulia granted options under its 2005 Stock Incentive Plan (as amended, “the 2005 Plan”) until September 2012 when the 2005 Plan was terminated. Stock options issued prior to the plan termination remained outstanding in accordance with their terms. Under the terms of the 2005 Plan, Trulia had the ability to grant incentive and nonqualified stock options, stock appreciation rights, restricted stock awards and restricted stock units. Options granted under the 2005 Plan generally vest at a rate of 25% after 12 months and ratably thereafter over the next 36 months and expire 10 years from the grant date. Certain options vest monthly over two to four years.

**Trulia 2012 Equity Incentive Plan, as Amended and Restated**

On September 19, 2012, Trulia’s 2012 Equity Incentive Plan (the “2012 Plan”) became effective. The 2012 Plan provides for the grant of incentive and nonqualified stock options, restricted stock, restricted stock units, stock appreciation rights, performance units and performance shares to employees, directors and consultants. Under the 2012 Plan, stock options are granted at a price per share not less than 100% of the fair market value per share of the underlying stock at the grant date. The plan administrator determines the vesting period for each option award on the grant date, and the options generally expire 10 years from the grant date or such shorter term as may be determined for the options. As noted above, we intend that future equity grants will be made under the 2011 Plan only.

**Option Awards**

The following table summarizes option award activity for the year ended December 31, 2018:

	<b>Number of Shares Subject to Existing Options</b>	<b>Weighted- Average Exercise Price Per Share</b>	<b>Weighted- Average Remaining Contractual Life (Years)</b>	<b>Aggregate Intrinsic Value (in thousands)</b>
Outstanding at January 1, 2018	26,645,206	\$ 27.70	5.72	\$ 355,739
Granted	6,963,320	48.95		
Exercised	(5,472,728)	21.94		
Forfeited or cancelled	(825,688)	35.32		
Outstanding at December 31, 2018	27,310,110	34.04	6.23	97,941
Vested and exercisable at December 31, 2018	15,287,932	29.73	4.72	75,867

The fair value of options granted is estimated at the date of grant using the Black-Scholes-Merton option-pricing model, assuming no dividends and with the following assumptions for the periods presented:

	<b>Year Ended December 31,</b>		
	<b>2018</b>	<b>2017</b>	<b>2016</b>
Expected volatility	42% – 45%	45% – 49%	49% – 51%
Expected dividend yield	—	—	—
Risk-free interest rate	2.52% – 2.84%	1.67% – 2.06%	0.89% – 1.89%
Weighted-average expected life	4.50 – 5.00 years	4.25 – 4.75 years	3.75 – 4.25 years
Weighted-average fair value of options granted	\$19.11	\$14.51	\$9.42

As of December 31, 2018, there was a total of \$176.7 million in unrecognized compensation cost related to unvested stock options, which is expected to be recognized over a weighted-average period of 2.7 years.

The total intrinsic value of options exercised during the years ended December 31, 2018, 2017 and 2016 was \$161.4 million, \$156.1 million and \$51.7 million, respectively. The fair value of options vested for the years ended December 31, 2018, 2017 and 2016 was \$87.7 million, \$84.8 million and \$87.9 million, respectively.

**Restricted Stock Units**

The following table summarizes activity for restricted stock units for the year ended December 31, 2018:

	<b>Restricted Stock Units</b>	<b>Weighted- Average Grant- Date Fair Value</b>
Unvested outstanding at January 1, 2018	4,016,405	\$ 33.22
Granted	3,725,726	48.26
Vested	(1,740,134)	35.63
Forfeited or cancelled	(735,673)	39.59
Unvested outstanding at December 31, 2018	<u>5,266,324</u>	<u>42.19</u>

The total fair value of vested restricted stock units was \$62.0 million, \$43.7 million and \$46.5 million, respectively, for the years ended December 31, 2018, 2017 and 2016.

The fair value of the outstanding restricted stock units will be recorded as share-based compensation expense over the vesting period. As of December 31, 2018, there was \$204.9 million of total unrecognized compensation cost related to restricted stock units, which is expected to be recognized over a weighted-average period of 2.9 years.

**Share-Based Compensation Expense**

The following table presents the effects of share-based compensation expense in our consolidated statements of operations during the periods presented (in thousands):

	<b>Year Ended December 31,</b>		
	<b>2018</b>	<b>2017</b>	<b>2016</b>
Cost of revenue	\$ 4,127	\$ 3,884	\$ 3,550
Sales and marketing	22,942	22,735	23,320
Technology and development	56,673	39,938	31,466
General and administrative	65,342	47,014	48,582
	<u>\$ 149,084</u>	<u>\$ 113,571</u>	<u>\$ 106,918</u>

**Note 18. Net Loss Per Share**

Basic net loss per share is computed by dividing net loss by the weighted-average number of shares (including Class A common stock, Class B common stock and Class C capital stock) outstanding during the period. In the calculation of basic net loss per share, undistributed earnings are allocated assuming all earnings during the period were distributed.

Diluted net loss per share is computed by dividing net loss by the weighted-average number of shares (including Class A common stock, Class B common stock and Class C capital stock) outstanding during the period and potentially dilutive Class A common stock and Class C capital stock equivalents, except in cases where the effect of the Class A common stock or Class C capital stock equivalent would be antidilutive. Potential Class A common stock and Class C capital stock equivalents consist of Class A common stock and Class C capital stock issuable upon exercise of stock options and Class A common stock and Class C capital stock underlying unvested restricted stock awards and unvested restricted stock units using the treasury stock method. Potential Class A common stock equivalents also include Class A common stock issuable upon conversion of the 2020 Notes using the if-converted method.

Since the Company expects to settle the principal amount of the outstanding 2021 Notes and 2023 Notes in cash, the Company uses the treasury stock method for calculating any potential dilutive effect of the conversion spread on diluted net income per share, if applicable. For the 2021 Notes, the conversion spread of approximately 8.8 million shares has a dilutive impact on diluted net income per share when the market price of the Company's Class C capital stock at the end of a period

exceeds the conversion price of \$52.36 per share. For the 2023 Notes, the conversion spread of approximately 4.8 million shares has a dilutive impact on diluted net income per share when the market price of the Company's Class C capital stock at the end of a period exceeds the conversion price of \$78.37 per share.

For the periods presented, the following Class A common stock and Class C capital stock equivalents were excluded from the calculations of diluted net loss per share because their effect would have been antidilutive (in thousands):

	Year Ended December 31,		
	2018	2017	2016
Weighted-average Class A common stock and Class C capital stock option awards outstanding	22,736	27,998	19,993
Weighted-average Class A common stock and Class C capital stock restricted stock units outstanding	4,949	4,262	3,607
Class A common stock issuable upon conversion of the 2020 Notes	400	435	440
Total Class A common stock and Class C capital stock equivalents	28,085	32,695	24,040

In the event of liquidation, dissolution, distribution of assets or winding-up of the Company, the holders of all classes of common and capital stock have equal rights to receive all the assets of the Company after the rights of the holders of preferred stock have been satisfied. We have not presented net loss per share under the two-class method for our Class A common stock, Class B common stock and Class C capital stock because it would be the same for each class due to equal dividend and liquidation rights for each class.

## Note 19. Commitments and Contingencies

### *Lease Commitments*

We have contractual obligations in the form of operating leases for office space and office equipment. The largest of these leases relates to our headquarters in Seattle, Washington, as well as our other offices in San Francisco, California, Denver, Colorado, Overland Park, Kansas, Irvine, California and New York, New York. Each of these leases contain periodic rent escalation adjustments and renewal options. Rent expense related to these leases is recorded on a straight-line basis. Our operating lease obligations expire at various dates with the latest maturity in 2024.

Future minimum payments for all operating leases as of December 31, 2018 are as follows (in thousands):

2019	\$	29,085
2020		38,060
2021		40,099
2022		37,721
2023		36,458
All future years		85,462
Total future minimum lease payments	\$	266,885

Rent expense for the years ended December 31, 2018, 2017 and 2016, was \$23.7 million, \$21.4 million and \$16.6 million, respectively.

### *Purchase Commitments*

Purchase commitments primarily included non-cancelable agreements to purchase content related to our mobile applications and websites as well as homes that the Company is under contract to purchase through Zillow Offers but that have not closed as of the respective date. The amounts due for these non-cancelable purchase commitments and homes under contract as of December 31, 2018 are as follows (in thousands):



	<b>Purchase Obligations</b>	<b>Homes Under Contract</b>
2019	\$ 64,124	\$ 88,943
2020	64,007	—
2021	32,735	—
Total future purchase commitments	<u>\$ 160,866</u>	<u>\$ 88,943</u>

### ***Surety Bonds***

In the course of business, we are required to provide financial commitments in the form of surety bonds to third parties as a guarantee of our performance on and our compliance with certain obligations. If we were to fail to perform or comply with these obligations, any draws upon surety bonds issued on our behalf would then trigger our payment obligation to the surety bond issuer. We have outstanding surety bonds issued for our benefit of approximately \$8.9 million and \$3.7 million as of December 31, 2018 and 2017, respectively.

### ***Legal Proceedings***

We are involved in a number of legal proceedings concerning matters arising in connection with the conduct of our business activities, some of which are at preliminary stages and some of which seek an indeterminate amount of damages. We regularly evaluate the status of legal proceedings in which we are involved to assess whether a loss is probable or there is a reasonable possibility that a loss or additional loss may have been incurred to determine if accruals are appropriate. We further evaluate each legal proceeding to assess whether an estimate of possible loss or range of loss can be made if accruals are not appropriate. For certain cases described below, management is unable to provide a meaningful estimate of the possible loss or range of possible loss because, among other reasons, (i) the proceedings are in preliminary stages; (ii) specific damages have not been sought; (iii) damages sought are, in our view, unsupported and/or exaggerated; (iv) there is uncertainty as to the outcome of pending appeals or motions; (v) there are significant factual issues to be resolved; and/or (vi) there are novel legal issues or unsettled legal theories presented. For these cases, however, management does not believe, based on currently available information, that the outcomes of these proceedings will have a material effect on our financial position, results of operations or cash flow.

In July 2015, VHT, Inc. (“VHT”) filed a complaint against us in the U.S. District Court for the Western District of Washington alleging copyright infringement of VHT’s images on the Zillow Digs site. In January 2016, VHT filed an amended complaint alleging copyright infringement of VHT’s images on the Zillow Digs site as well as the Zillow listing site. In December 2016, the court granted a motion for partial summary judgment that dismissed VHT’s claims with respect to the Zillow listing site. A federal jury trial began on January 23, 2017, and on February 9, 2017, the jury returned a verdict finding that the Company had infringed VHT’s copyrights in images displayed or saved to the Digs site. The jury awarded VHT \$79,875 in actual damages and approximately \$8.2 million in statutory damages. In March 2017, the Company filed motions in the district court seeking judgment for the Company on certain claims that are the subject of the verdict, and for a new trial on others. On June 20, 2017, the judge ruled and granted in part our motions, finding that VHT failed to present sufficient evidence to prove direct copyright infringement for a portion of the images, reducing the total damages to approximately \$4.1 million. On October 26, 2017, the Company filed an appeal with the Ninth Circuit Court of Appeals seeking review of the final judgment and certain prior rulings entered by the district court. The oral hearing for the appeal took place on August 28, 2018. We have recorded an estimated liability for approximately \$4.1 million as of December 31, 2018 and December 31, 2017. We do not believe there is a reasonable possibility that a material loss in excess of amounts accrued may be incurred.

In August and September 2017, two purported class action lawsuits were filed against us and certain of our executive officers, alleging, among other things, violations of federal securities laws on behalf of a class of those who purchased our common stock between February 12, 2016 and August 8, 2017. One of those purported class actions, captioned Vargosko v. Zillow Group, Inc. et al, was brought in the U.S. District Court for the Central District of California. The other purported class action lawsuit, captioned Shotwell v. Zillow Group, Inc. et al, was brought in the U.S. District Court for the Western District of Washington. The complaints allege, among other things, that during the period between February 12, 2016 and August 8, 2017, we issued materially false and misleading statements regarding our business practices. The complaints seek to recover, among other things, alleged damages sustained by the purported class members as a result of the alleged misconduct. In November

2017, an amended complaint was filed against us and certain of our executive officers in the Shotwell v. Zillow Group class action lawsuit, extending the beginning of the class period to November 17, 2014. In January 2018, the Vargosko v. Zillow Group class action lawsuit was transferred to the U.S. District Court for the Western District of Washington and consolidated with the Shotwell v. Zillow Group class action lawsuit, and the court appointed lead plaintiffs in the consolidated lawsuit. In February 2018, lead plaintiffs filed a consolidated amended complaint, and in April 2018, we filed our motion to dismiss the consolidated amended complaint. Our motion to dismiss the consolidated amended complaint was fully briefed in June 2018. On October 2, 2018, the court granted our motion to dismiss, although the court gave lead plaintiffs 45 days, or until November 16, 2018, to file a second consolidated amended complaint and attempt to cure the defects in their consolidated amended complaint. On November 16, 2018, lead plaintiffs filed a second consolidated amended complaint, which we moved to dismiss on December 17, 2018. We anticipate that briefing on our motion to dismiss the second consolidated amended complaint will be complete by February 6, 2019. We have denied the allegations of wrongdoing and intend to vigorously defend the claims in this lawsuit. We have not recorded an accrual related to this lawsuit as of December 31, 2018 and December 31, 2017, as we do not believe a loss is probable.

In October and November 2017 and January and February 2018, four shareholder derivative lawsuits were filed in the U.S. District Court for the Western District of Washington and the Superior Court of the State of Washington, against certain of our executive officers and directors seeking unspecified damages on behalf of the Company and certain other relief, such as reform to corporate governance practices. The plaintiffs in the derivative lawsuits (in which the Company is a nominal defendant) allege, among other things, that the defendants breached their fiduciary duties in connection with oversight of public statements and legal compliance, and as a result of the breach of such fiduciary duties, the Company was damaged, and defendants were unjustly enriched. Certain of the plaintiffs also allege, among other things, violations of Section 14(a) of the Securities Exchange Act of 1934 and waste of corporate assets. All four of the shareholder derivative lawsuits have been stayed until after final resolution of the pending motion to dismiss and related appeals, if any, in the consolidated securities class action lawsuit discussed above. The defendants intend to deny the allegations of wrongdoing and vigorously defend the claims in these lawsuits. We have not recorded an accrual related to these lawsuits as of December 31, 2018 and December 31, 2017, as we do not believe a loss is probable.

In addition to the matters discussed above, from time to time, we are involved in litigation and claims that arise in the ordinary course of business. Although we cannot be certain of the outcome of any such litigation or claims, nor the amount of damages and exposure that we could incur, we currently believe that the final disposition of such matters will not have a material effect on our business, financial position, results of operations or cash flow. Regardless of the outcome, litigation can have an adverse impact on us because of defense and settlement costs, diversion of management resources and other factors.

### ***Indemnifications***

In the ordinary course of business, we enter into contractual arrangements under which we agree to provide indemnification of varying scope and terms to business partners and other parties with respect to certain matters, including, but not limited to, losses arising out of the breach of such agreements and out of intellectual property infringement claims made by third parties. In addition, we have agreements that indemnify certain issuers of surety bonds against losses that they may incur as a result of executing surety bonds on our behalf. For our indemnification arrangements, payment may be conditional on the other party making a claim pursuant to the procedures specified in the particular contract. Further, our obligations under these agreements may be limited in terms of time and/or amount, and in some instances, we may have recourse against third parties for certain payments. In addition, we have indemnification agreements with certain of our directors and executive officers that require us, among other things, to indemnify them against certain liabilities that may arise by reason of their status or service as directors or officers. The terms of such obligations may vary.

### **Note 20. Related Party Transactions**

In February 2016, we paid a total of approximately \$0.2 million and \$0.2 million, respectively, to Mr. Lloyd Frink, our Vice Chairman and President, and Mr. Richard Barton, our Executive Chairman, for reimbursement of costs incurred by Mr. Frink and Mr. Barton for use of private planes by certain of the Company's employees and Mr. Frink and Mr. Barton for business travel in prior years.

In April 2016, we paid approximately \$0.1 million for a tax “gross-up” payment to Mr. Richard Barton, our Executive Chairman, to cover the imputed income associated with a 2015 Federal Trade Commission filing made on behalf of Mr. Barton under the Hart-Scott-Rodino Antitrust Improvements Act of 1976, which filing was required due to Mr. Barton’s ownership of Zillow, Inc.’s common stock.

#### **Note 21. Self-Insurance**

We are self-insured for medical benefits, and beginning on January 1, 2018 for dental benefits, for all qualifying Zillow Group employees. The medical plan carries a stop-loss policy which will protect when cumulative medical claims exceed 125% of expected claims for the plan year with a limit of \$1.0 million and from individual claims during the plan year exceeding \$150,000. We record estimates of the total costs of claims incurred based on an analysis of historical data and independent estimates. Our liability for self-insured claims is included within accrued compensation and benefits in our consolidated balance sheet and was \$3.9 million and \$2.0 million, respectively, as of December 31, 2018 and 2017.

#### **Note 22. Employee Benefit Plan**

We have a defined contribution 401(k) retirement plan covering Zillow Group employees who have met certain eligibility requirements (the “Zillow Group 401(k) Plan”). Eligible employees may contribute pretax compensation up to a maximum amount allowable under the Internal Revenue Service limitations. Employee contributions and earnings thereon vest immediately. We currently match up to 4% of employee contributions under the Zillow Group 401(k) Plan. The total expense related to the Zillow Group 401(k) Plan was \$16.0 million, \$12.3 million and \$10.1 million, respectively, for the years ended December 31, 2018, 2017 and 2016.

#### **Note 23. Segment Information and Revenue**

Beginning in the second quarter of 2018, we have two operating and reportable segments, which have been identified based on the way in which our chief operating decision-maker manages our business, makes operating decisions and evaluates operating performance. Our chief executive officer acts as the chief operating decision-maker and reviews financial and operational information of the IMT and Homes segments.

The IMT segment includes the financial results for the Premier Agent, Rentals, Mortgages and new construction marketplaces, dotloop, and display, as well as revenue from the sale of various other marketing and business products and services to real estate professionals. The Homes segment includes the financial results from Zillow Group’s buying and selling of homes directly.

Revenue and costs are generally directly attributed to our segments. However, due to the integrated structure of our business, certain costs incurred by one segment may benefit the other segment. These costs are generally headcount-related and are allocated to each segment based on the estimated effort attributable to each segment.

Our chief executive officer reviews information about our revenue categories as well as statement of operations data inclusive of loss before income taxes by segment. This information is included in the following table for the period presented (in thousands):

	Year Ended December 31, 2018		
	IMT	Homes	Consolidated
Revenue:			
Premier Agent	\$ 898,332	\$ —	\$ 898,332
Rentals	134,587	—	134,587
Mortgages	80,046	—	80,046
Other	168,224	—	168,224
Homes	—	52,365	52,365
Total revenue	1,281,189	52,365	1,333,554
Costs and expenses:			
Cost of revenue	104,330	49,260	153,590
Sales and marketing	534,038	18,583	552,621
Technology and development	389,539	21,279	410,818
General and administrative	238,727	23,426	262,153
Impairment costs	79,000	—	79,000
Acquisition-related costs	2,332	—	2,332
Integration costs	2,015	—	2,015
Total costs and expenses	1,349,981	112,548	1,462,529
Income (loss) from operations	(68,792)	(60,183)	(128,975)
Other income	19,270	—	19,270
Interest expense	(39,078)	(2,177)	(41,255)
Loss before income taxes	\$ (88,600)	\$ (62,360)	\$ (150,960)

We have not presented the comparable 2017 or 2016 periods in the table above because we had one operating and reportable segment prior to 2018.

## Note 24. Subsequent Events

### *Entry into Revolving Credit Agreement*

On January 31, 2019, certain of Zillow Group's wholly owned subsidiaries entered into a revolving credit agreement with Citibank, N.A., as the directing lender, and certain other parties thereto (the "Credit Agreement"). The Credit Agreement provides for a maximum borrowing capacity of \$500.0 million (the "Maximum Amount") with an initial borrowing capacity of \$50.0 million, which amount may be increased up to the Maximum Amount subject to the satisfaction of certain conditions, through a non-recourse credit facility secured by a pledge of the equity of certain subsidiaries that purchase and sell select residential properties through Zillow Offers. The Credit Agreement has an initial term of two years which may be extended for up to one year, subject to the satisfaction of certain conditions. The Credit Agreement includes customary representations and warranties, covenants (including financial covenants applicable to the Company), and provisions regarding events of default.

### *Appointment of CEO; Compensatory Arrangements*

On February 21, 2019, Zillow Group announced the appointment of Richard N. Barton as Zillow Group's Chief Executive Officer, effective February 21, 2019. Mr. Barton will succeed Spencer Rascoff, who has served as Zillow Group's Chief Executive Officer since 2010 and who will remain a member of Zillow Group's board of directors. Mr. Barton also will remain a member of Zillow Group's board of directors. In connection with Mr. Rascoff's resignation as Chief Executive Officer, which occurred on February 21, 2019, Zillow Group entered into an Executive Departure Agreement and Release (the

“Agreement”) with Mr. Rascoff. Pursuant to the Agreement, Mr. Rascoff will remain a full-time employee of Zillow Group at his current level of compensation and benefits until March 22, 2019 (the “Departure Date”) in order to provide transition services until such date. Mr. Rascoff will remain a member of Zillow Group’s board of directors.

Pursuant to the Agreement, Mr. Rascoff will be eligible to receive, among other things, accelerated vesting of outstanding stock options held by Mr. Rascoff as of the Departure Date by an additional eighteen months from the Departure Date. Options not vested as of the Departure Date, taking into account the foregoing vesting acceleration, will terminate. Each of Mr. Rascoff’s vested stock options that are outstanding as of the Departure Date will remain exercisable until, except for any later date contemplated by the following proviso, the later of (x) the third anniversary of the Departure Date and (y) the latest day upon which the option would have expired by its original terms under any circumstances (the “Option Expiration Outside Date”); provided, however, that the options will remain exercisable for so long as Mr. Rascoff serves on Zillow Group’s board of directors (but not later than any applicable Option Expiration Outside Date), and if Mr. Rascoff ceases to serve on Zillow Group’s board of directors on or after the third anniversary of the Departure Date, each option will remain exercisable until the earlier of (i) ninety days from the final date of Mr. Rascoff’s service on Zillow Group’s board of directors and (ii) the applicable Option Expiration Outside Date. The vesting acceleration pursuant to the Agreement will be accounted for as a modification, and we expect to record a material amount of share-based compensation expense associated with this modification in the three months ended March 31, 2019.

**Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure.**

(a) The Audit Committee (the “Audit Committee”) of the Board of Directors of the Company conducted a comprehensive, competitive process to determine the Company’s independent registered public accounting firm for the Company’s fiscal year ending December 31, 2017. As a result of this process, the Audit Committee approved the dismissal of Ernst & Young LLP (“EY”), effective upon issuance by EY of its reports on the Company’s consolidated financial statements as of and for the year ended December 31, 2016 and the effectiveness of internal control over financial reporting as of December 31, 2016 included in the filing of the Company’s Annual Report on Form 10-K for the fiscal year ended December 31, 2016 (“2016 Annual Report”). The 2016 Annual Report was filed on February 7, 2017, and therefore, the effective date of EY’s dismissal was February 7, 2017.

The reports of EY on the Company’s consolidated financial statements for the years ended December 31, 2016 did not contain an adverse opinion or a disclaimer of opinion, and were not qualified or modified as to uncertainty, audit scope, or accounting principle.

During the fiscal year ended December 31, 2016 and during the subsequent interim period through February 7, 2017, there were no disagreements (as that term is defined in Item 304(a)(1)(iv) of Regulation S-K) between the Company and EY on any matter of accounting principles or practices, financial statement disclosure, or auditing scope or procedure, which disagreements, if not resolved to the satisfaction of EY, would have caused EY to make reference to the subject matter of the disagreements in connection with EY’s report on the Company’s consolidated financial statements for such fiscal years. During the fiscal year ended December 31, 2016 and during the subsequent interim period through February 7, 2017, there were no reportable events (as defined in Item 304(a)(1)(v) of Regulation S-K).

The Company provided EY with the statements made by the Company in response to Item 304(a) of Regulation S-K prior to its filing with the Securities and Exchange Commission (“SEC”) and requested that EY provide the Company with letters addressed to the SEC stating whether EY agrees with the statements made by the Company in response to Item 304(a) of Regulation S-K. A copy of these letters, dated August 4, 2016 and February 7, 2017, furnished by EY in response to the Company’s request, are filed as Exhibit 16.1 and Exhibit 16.2 to this report, respectively.

(b) On August 3, 2016, the Audit Committee approved the engagement of Deloitte & Touche LLP (“Deloitte”) as the Company’s independent registered public accounting firm for the Company’s fiscal year ending December 31, 2017. During the fiscal years ended December 31, 2015 and 2016 and during the subsequent period through the date of the engagement of Deloitte, neither the Company nor anyone acting on its behalf has consulted with Deloitte regarding:

- (i) The application of accounting principles to a specified transaction, either completed or proposed, or
- (ii) The type of audit opinion that might be rendered on the Company’s financial statements, and either a written report was provided to the Company or oral advice was provided that Deloitte concluded was an important factor considered by the Company in reaching a decision as to an accounting, auditing or financial reporting issue; or
- (iii) Any matter that was either the subject of a disagreement or a reportable event, as each term is defined in Items 304(a)(1)(iv) or (v) of Regulation S-K, respectively.

There were no disagreements with Deloitte on accounting and financial disclosure matters from the date of the engagement of Deloitte through the year ended December 31, 2018, or in any period subsequent to such date, through the date of this report.



**Item 9A. Controls and Procedures.*****Evaluation of Disclosure Controls and Procedures***

The Company carried out an evaluation, with the participation of our management, and under the supervision of our Chief Executive Officer and Chief Financial Officer, of the effectiveness of our disclosure controls and procedures (as defined under Rule 13a-15(e) and Rule 15d-15(e) under the Exchange Act) as of the end of the period covered by this report. Based upon that evaluation, our Chief Executive Officer and Chief Financial Officer concluded that our disclosure controls and procedures were effective as of December 31, 2018.

***Management's Report on Internal Control Over Financial Reporting***

Our management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined under Rule 13a-15(f) under the Exchange Act. Under the supervision and with the participation of our management, including our Chief Executive Officer and Chief Financial Officer, we conducted an evaluation of the effectiveness of our internal control over financial reporting based on the framework in Internal Control – Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework). Based on our evaluation, our management concluded that our internal control over financial reporting was effective as of December 31, 2018.

We intend to regularly review and evaluate the design and effectiveness of our disclosure controls and procedures and internal control over financial reporting on an ongoing basis and to improve these controls and procedures over time and to correct any deficiencies that we may discover in the future. While we believe the present design of our disclosure controls and procedures and internal control over financial reporting are effective, future events affecting our business may cause us to modify our controls and procedures.

The Company's independent registered public accounting firm has issued an attestation report regarding its assessment of the effectiveness of the Company's internal control over financial reporting as of December 31, 2018.

***Changes in Internal Control over Financial Reporting***

Except for the implementation of certain internal controls related to our January 1, 2018 adoption of guidance issued by the Financial Accounting Standards Board on revenue from contracts with customers, there were no other changes in our internal control over financial reporting identified in connection with the evaluation required by Rule 13a-15(d) and 15d-15(d) of the Exchange Act that occurred during the year ended December 31, 2018 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting. There were no changes in our internal control over financial reporting identified in connection with the evaluation required by Rule 13a-15(d) and 15d-15(d) of the Exchange Act that occurred during the three months ended December 31, 2018 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

**REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM**

The Board of Directors and Shareholders of Zillow Group, Inc.

**Opinion on Internal Control over Financial Reporting**

We have audited the internal control over financial reporting of Zillow Group, Inc. (the “Company”) as of December 31, 2018, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2018, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by COSO.

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated financial statements of the Company as of and for the year ended December 31, 2018, and our report dated February 21, 2019 expressed an unqualified opinion on those financial statements and included an explanatory paragraph related to the Company’s change in method of accounting for costs to obtain customer contracts during the year ended December 31, 2018 due to the adoption of the new revenue standard.

**Basis for Opinion**

The Company’s management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management’s Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company’s internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

**Definition and Limitations of Internal Control over Financial Reporting**

A company’s internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company’s internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company’s assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Seattle, Washington  
February 21, 2019

/s/ DELOITTE & TOUCHE LLP

**Item 9B. Other Information.**

None.

**PART III****Item 10. Directors, Executive Officers and Corporate Governance.**

The information required by this item is incorporated by reference to the Company's definitive proxy statement relating to the 2019 annual meeting of shareholders. The definitive proxy statement will be filed with the Securities and Exchange Commission within 120 days after the end of the 2018 fiscal year.

We have adopted a Code of Ethics that applies to our Chief Executive Officer, Chief Financial Officer, Chief Accounting Officer, controller and persons performing similar functions. The Code of Ethics is posted on our website at <http://investors.zillowgroup.com/corporate-governance.cfm>. We intend to satisfy the disclosure requirements under Item 5.05 of Form 8-K regarding an amendment to, or waiver from, a provision of the Code of Ethics by posting such information on our website at the address specified above.

**Item 11. Executive Compensation.**

The information required by this item is incorporated by reference to the Company's definitive proxy statement relating to the 2019 annual meeting of shareholders. The definitive proxy statement will be filed with the Securities and Exchange Commission within 120 days after the end of the 2018 fiscal year.

**Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.**

The information required by this item is incorporated by reference to the Company's definitive proxy statement relating to the 2019 annual meeting of shareholders. The definitive proxy statement will be filed with the Securities and Exchange Commission within 120 days after the end of the 2018 fiscal year.

**Item 13. Certain Relationships and Related Transactions, and Director Independence.**

The information required by this item is incorporated by reference to the Company's definitive proxy statement relating to the 2019 annual meeting of shareholders. The definitive proxy statement will be filed with the Securities and Exchange Commission within 120 days after the end of the 2018 fiscal year.

**Item 14. Principal Accountant Fees and Services.**

The information required by this item is incorporated by reference to the Company's definitive proxy statement relating to the 2019 annual meeting of shareholders. The definitive proxy statement will be filed with the Securities and Exchange Commission within 120 days after the end of the 2018 fiscal year.

**PART IV****Item 15. Exhibits, Financial Statement Schedules.***(a)(1) Financial Statements*

We have filed the financial statements listed in the Index to Consolidated Financial Statements as a part of this Annual Report on Form 10-K.

*(a)(2) Financial Statement Schedules*

All financial statement schedules have been omitted because they are not applicable, not material or the required information is presented in the financial statements or the notes thereto.

*(a)(3) Exhibits*

Certain of the following exhibits have heretofore been filed with the Securities and Exchange Commission and are incorporated by reference from the documents described in parentheses. Certain others are filed herewith. The exhibits are numbered in accordance with Item 601 of Regulation S-K. In reviewing the agreements included as exhibits to this Annual Report on Form 10-K, please remember that they are included to provide you with information regarding their terms and are not intended to provide any other factual or disclosure information about the Company or the other parties to the agreement. The agreements may contain representations and warranties by each of the parties to the applicable agreement. These representations and warranties have been made solely for the benefit of the other party or parties to the applicable agreement and (i) should not be treated as categorical statements of fact, but rather as a means of allocating the risk to one of the parties if those statements prove to be inaccurate; (ii) may have been qualified by disclosures that were made to the other party or parties in connection with the negotiation of the applicable agreement, which disclosures are not necessarily reflected in the agreement; (iii) may apply standards of materiality in a manner that is different from what may be viewed as material to you or other investors; and (iv) were made only as of the date of the applicable agreement or other date or dates that may be specified in the agreement and are subject to more recent developments. Accordingly, these representations and warranties may not describe the actual state of affairs as of the date they were made or at any other time. Additional information about the Company may be found elsewhere in this Annual Report on Form 10-K and the Company's other public filings, which are available without charge through the SEC's website at <http://www.sec.gov>.

<b><u>Exhibit Number</u></b>	<b><u>Description</u></b>
2.1+	Agreement and Plan of Merger, dated August 16, 2013, by and among Zillow, Inc., NMD Interactive, Inc., d/b/a StreetEasy, Strawberry Acquisition, Inc. and Shareholder Representative Services LLC (Filed as Exhibit 2.1 to Zillow, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on August 19, 2013, and incorporated herein by reference).
3.1	Amended and Restated Articles of Incorporation of Zillow Group, Inc. (Filed as Exhibit 3.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on February 17, 2015, and incorporated herein by reference).
3.2	Amended and Restated Bylaws of Zillow Group, Inc. (Filed as Exhibit 3.2 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on February 17, 2015, and incorporated herein by reference).
4.1	Specimen of Class A Common Stock Certificate (Filed as Exhibit 4.1 to Registrant's Quarterly Report on Form 10-Q filed on May 12, 2015, and incorporated herein by reference).
4.2	Specimen of Class C Capital Stock Certificate (Filed as Exhibit 4.1 Registrant's Form 8-A filed with the Securities and Exchange Commission on July 29, 2015, and incorporated herein by reference).

<u>Exhibit Number</u>	<u>Description</u>
4.3	Indenture, dated as of December 17, 2013, between Trulia, Inc. and Wells Fargo Bank, National Association, as trustee (Filed as Exhibit 4.1 to Trulia, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission (File No. 001-35650) on December 17, 2013, and incorporated herein by reference).
4.4	Form of Note for Trulia, Inc.'s 2.75% Convertible Senior Notes due 2020 (incorporated by reference to Exhibit 4.1 hereto).
4.5	Supplemental Indenture, dated as of February 17, 2015, among Zillow Group, Inc., Trulia, Inc. and Wells Fargo Bank, National Association, as trustee (Filed as Exhibit 4.2 to Registrant's Current Report on Form 8-K12B filed with the Securities and Exchange Commission on February 17, 2015, and incorporated herein by reference).
4.6	Second Supplemental Indenture, dated as of December 30, 2015, among Zillow Group, Inc., Trulia, Inc. and Wells Fargo Bank, National Association, as trustee (Filed as Exhibit 4.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on December 30, 2015, and incorporated herein by reference).
4.7	Transfer Restriction Agreement and Amendment to Noncompetition Agreement, dated July 20, 2015, among Zillow Group, Inc., Zillow, Inc., Richard Barton and the other holders signatory thereto (Filed as Exhibit 10.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on July 21, 2015, and incorporated herein by reference).
4.8	Transfer Restriction Agreement and Amendment to Noncompetition Agreement, dated July 20, 2015, among Zillow Group, Inc., Zillow, Inc., Lloyd Frink and the other holders signatory thereto (Filed as Exhibit 10.2 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on July 21, 2015, and incorporated herein by reference).
4.9	Indenture, dated as of December 12, 2016, by and between Zillow Group, Inc. and The Bank of New York Mellon Trust Company, National Association, as trustee (Filed as Exhibit 4.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on December 12, 2016, and incorporated herein by reference).
4.10	Form of Note for Zillow Group, Inc.'s 2.00% Convertible Senior Notes due 2021 (incorporated by reference from Exhibit A to Exhibit 4.3 hereto).
4.11	Indenture, dated as of July 3, 2018, by and between Zillow Group, Inc. and The Bank of New York Mellon Trust Company, N.A., as trustee (Filed as Exhibit 4.1 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on July 3, 2018, and incorporated herein by reference).
4.12	Form of 1.50% Convertible Senior Note due 2023 (included in Exhibit 4.1 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on July 3, 2018, and incorporated herein by reference).
10.1*	Zillow, Inc. Amended and Restated 2005 Equity Incentive Plan (Filed as Exhibit 10.5 to Zillow, Inc.'s Amendment No. 3 to Registration Statement on Form S-1 filed with the Securities and Exchange Commission (SEC File No. 333-173570) on June 20, 2011, and incorporated herein by reference).
10.2*	Form of Stock Option Grant Notice and Stock Option Agreement under the Zillow, Inc. Amended and Restated 2005 Equity Incentive Plan (Filed as Exhibit 10.6 to Zillow, Inc.'s Registration Statement on Form S-1 filed with the Securities and Exchange Commission (SEC File No. 333-173570) filed on April 18, 2011, and incorporated herein by reference).
10.3*	Market Leader, Inc. Amended and Restated 2004 Equity Incentive Plan (Filed as Appendix A to Market Leader, Inc.'s Definitive Proxy Statement on Schedule 14A filed with the Securities Exchange Commission (SEC File No. 000- 51032) on April 10, 2009, and incorporated herein by reference).
10.4*	Trulia, Inc. 2005 Stock Incentive Plan, as amended, and form of Stock Option Agreement and form of Stock Option Grant Notice thereunder (Filed as Exhibit 10.2 to Trulia, Inc.'s Form S-1 filed with the Securities and Exchange Commission (SEC File No. 333-183364) on August 17, 2012, and incorporated herein by reference).
10.5*	Zillow, Inc. Amended and Restated 2011 Equity Incentive Plan (Filed as Appendix A to Zillow, Inc.'s Definitive Proxy Statement filed with the Securities and Exchange Commission (SEC File No. 001-35237) on April 17, 2012, and incorporated herein by reference).



<u>Exhibit Number</u>	<u>Description</u>
10.6*	Amendment No. 1 to the Zillow, Inc. Amended and Restated 2011 Incentive Plan (Filed as Appendix A to Zillow, Inc.'s Definitive Proxy Statement filed with the Securities and Exchange Commission (SEC File No. 001-35237) on April 16, 2013, and incorporated herein by reference).
10.7*	Form of Stock Option Grant Notice and Stock Option Agreement under the Zillow, Inc. 2011 Incentive Plan (Filed as Exhibit 10.3 to Zillow, Inc.'s Amendment No. 3 to Registration Statement on Form S-1 filed with the Securities and Exchange Commission (SEC File No. 333-173570) on June 20, 2011, and incorporated herein by reference).
10.8*	Form of Restricted Stock Unit Award Notice and Restricted Stock Unit Award Agreement under the Zillow, Inc. Amended and Restated 2011 Incentive Plan (Filed as Exhibit 10.2 to Zillow, Inc.'s Form 10-Q filed with the Securities and Exchange Commission on May 8, 2014, and incorporated herein by reference).
10.9*	Form of Restricted Unit Award Notice and Restricted Unit Award Agreement under the Zillow, Inc. Amended and Restated 2011 Incentive Plan (Filed as Exhibit 10.3 to Zillow, Inc.'s Form 10-Q filed with the Securities and Exchange Commission on May 8, 2014, and incorporated herein by reference).
10.10*	Amended and Restated Stock Option Grant Program for Nonemployee Directors under the Zillow, Inc. Amended and Restated 2011 Incentive Plan (Filed as Exhibit 10.11 to Registrant's Quarterly Report on Form 10-Q filed on May 12, 2015, and incorporated herein by reference).
10.11*	Amended and Restated Stock Option Grant Program for Nonemployee Directors under the Zillow Group, Inc. Amended and Restated 2011 Incentive Plan (Filed as Exhibit 10.1 to Registrant's Quarterly Report on Form 10-Q filed on May 4, 2016, and incorporated herein by reference).
10.12*	Amended and Restated Stock Option Grant Program for Nonemployee Directors under the Zillow Group, Inc. Amended and Restated 2011 Incentive Plan (Filed as Exhibit 10.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on February 13, 2017, and incorporated herein by reference).
10.13*	Form of Stock Option Grant Notice and Stock Option Agreement under the Zillow, Inc. Amended and Restated 2011 Incentive Plan (Assumed by Registrant; Filed as Exhibit 10.12 to Registrant's Quarterly Report on Form 10-Q filed on May 12, 2015, and incorporated herein by reference).
10.14*	Form of Restricted Stock Unit Award Notice and Restricted Stock Unit Award Agreement under the Zillow, Inc. Amended and Restated 2011 Incentive Plan (Assumed by Registrant; Filed as Exhibit 10.13 to Registrant's Quarterly Report on Form 10-Q filed on May 12, 2015, and incorporated herein by reference).
10.15*	Trulia, Inc. 2012 Equity Incentive Plan, as amended and restated (Filed as Exhibit 10.1 to Trulia, Inc.'s Form 10-Q filed with the Securities and Exchange Commission (File No. 001-35650) on August 12, 2013, and incorporated herein by reference).
10.16*	Form of Nonqualified Stock Option Grant Notice and Stock Option Agreement under the Trulia, Inc. 2012 Equity Incentive Plan (Assumed by Registrant; Filed as Exhibit 10.15 to Registrant's Quarterly Report on Form 10-Q filed on May 12, 2015, and incorporated herein by reference).
10.17*	Form of Restricted Stock Unit Award Notice and Restricted Stock Unit Award Agreement under the Trulia, Inc. 2012 Equity Incentive Plan (Assumed by Registrant; Filed as Exhibit 10.16 to Registrant's Quarterly Report on Form 10-Q filed on May 12, 2015, and incorporated herein by reference).
10.18*	Executive Employment Agreement by and between Spencer M. Rascoff and Zillow, Inc. (Filed as Exhibit 10.14 to Zillow, Inc.'s Amendment No. 1 to Registration Statement on Form S-1 filed with the Securities and Exchange Commission (SEC File No. 333-173570) on May 23, 2011, and incorporated herein by reference).
10.19*	Executive Employment Agreement by and between Kathleen Philips and Zillow, Inc. (Filed as Exhibit 10.16 to Zillow, Inc.'s Amendment No. 1 to Registration Statement on Form S-1 filed with the Securities and Exchange Commission (SEC File No. 333-173570) on May 23, 2011, and incorporated herein by reference).
10.20*	Amended and Restated Executive Employment Agreement by and between Errol Samuelson and Zillow, Inc. (Filed as Exhibit 10.1 to Zillow, Inc.'s Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on May 8, 2014, and incorporated herein by reference).

<u>Exhibit Number</u>	<u>Description</u>
10.21*	Amendment No. 1 to the Amended and Restated Executive Employment Agreement, dated March 25, 2016, by and between Errol Samuelson and Zillow, Inc. (Filed as Exhibit 10.3 to Zillow, Inc.'s Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on May 4, 2016, and incorporated herein by reference).
10.22*	Letter Agreement dated April 23, 2015 by and between Zillow Group, Inc. and Greg M. Schwartz (Filed as Exhibit 10.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on April 28, 2015, and incorporated herein by reference).
10.23*	Amended and Restated Letter Agreement dated August 3, 2015, by and between Zillow Group, Inc. and Greg M. Schwartz (Filed as Exhibit 10.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on August 3, 2015, and incorporated herein by reference).
10.24*	Letter Agreement dated February 24, 2016 by and between Zillow Group, Inc. and Greg M. Schwartz (Filed as Exhibit 10.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on February 29, 2016, and incorporated herein by reference).
10.25*	Letter Agreement dated March 6, 2017 by and between Zillow Group, Inc. and Greg M. Schwartz (Filed as Exhibit 10.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on March 8, 2017, and incorporated herein by reference).
10.26*	Form of Confidential Information, Inventions, and Nonsolicitation Agreement for certain officers of Zillow, Inc. (Filed as Exhibit 10.4 to Zillow, Inc.'s Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on May 8, 2014, and incorporated herein by reference).
10.27*	Forms of Confidential Information, Inventions, Nonsolicitation and Noncompetition Agreement for the Officers of Zillow Group, Inc. (Filed as Exhibit 10.29 to Registrant's Quarterly Report on Form 10-Q filed on May 12, 2015, and incorporated herein by reference).
10.28*	Form of Indemnification Agreement between Zillow Group, Inc. and each of its directors and executive officers (Filed as Exhibit 10.9 to Registrant's Current Report on Form 8-K12B filed with the Securities and Exchange Commission on February 17, 2015, and incorporated herein by reference).
10.29*	Zillow Group, Inc. Amended and Restated 2011 Incentive Plan (Filed as Exhibit 10.3 to Registrant's Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on August 5, 2016, and incorporated herein by reference).
10.30*	Form of Stock Option Grant Notice and Stock Option Agreement under the Zillow Group, Inc. Amended and Restated 2011 Incentive Plan (Filed as Exhibit 10.2 to Registrant's Quarterly Report on Form 10-Q filed on August 5, 2015, and incorporated herein by reference).
10.31*	Form of Restricted Stock Unit Award Notice and Restricted Stock Unit Award Agreement under the Zillow Group, Inc. Amended and Restated 2011 Incentive Plan (Filed as Exhibit 10.3 to Registrant's Quarterly Report on Form 10-Q filed on August 5, 2015, and incorporated herein by reference).
10.32	Office Lease between The Northwestern Mutual Life Insurance Company and Zillow, Inc. dated March 22, 2011 (Filed as Exhibit 10.10 to Zillow, Inc.'s Registration Statement on Form S-1 (SEC File No. 333-173570) filed on April 18, 2011, and incorporated herein by reference).
10.33	Amendment to Office Lease by and between FSP-RIC LLC and Zillow, Inc., dated as of June 27, 2012 (Filed as Exhibit 10.1 to Zillow, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on June 29, 2012, and incorporated herein by reference).
10.34	Second Amendment to Lease by and between FSP-RIC, LLC and Zillow, Inc., dated as of April 16, 2013 (Filed as Exhibit 10.1 to Zillow, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on April 22, 2013, and incorporated herein by reference).
10.35	Third Amendment to Lease by and between FSP-RIC, LLC and Zillow, Inc., dated as of January 10, 2014 (Filed as Exhibit 10.10 to Zillow, Inc.'s Form 10-K filed with the Securities and Exchange Commission on February 18, 2014, and incorporated herein by reference).
10.36	Fourth Amendment to Lease by and between FSP-RIC, LLC and Zillow, Inc., dated as of May 2, 2014 (Filed as Exhibit 10.1 to Zillow, Inc.'s Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on August 6, 2014, and incorporated herein by reference).

<u>Exhibit Number</u>	<u>Description</u>
10.37	Fifth Amendment to Lease by and between FSP-RIC, LLC and Zillow, Inc., dated as of November 19, 2014 (Filed as Exhibit 10.1 to Zillow, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on November 24, 2014, and incorporated herein by reference).
10.38	Sixth Amendment to Lease by and between FSP-RIC, LLC and Zillow, Inc., dated as of June 21, 2016 (Filed as Exhibit 10.1 to Registrant's Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on August 5, 2016, and incorporated herein by reference).
10.39	Lease, dated March 10, 2014, between Trulia and BXP Mission 535 LLC (Filed as Exhibit 10.1 to Trulia, Inc.'s Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on May 2, 2014, and incorporated herein by reference).
10.40	Amendment to Office Lease, dated July 25, 2014, between Trulia and BXP Mission 535 LLC (Filed as Exhibit 10.1 to Trulia, Inc.'s Form 10-Q filed with the Securities and Exchange Commission on August 8, 2014, and incorporated herein by reference).
10.41	Settlement Agreement and Release, dated as of June 6, 2016, among Move, Inc., Real Select, Inc., Top Producer Systems Company, National Association of Realtors, Realtors Information Network, Inc., Zillow, Inc., Errol Samuelson, and Curt Beardsley (Filed as Exhibit 10.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on June 6, 2016, and incorporated herein by reference).
10.42	Base Capped Call Confirmation, dated December 6, 2016, between Zillow Group, Inc. and Citigroup Global Markets Inc. (Filed as Exhibit 10.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on December 12, 2016, and incorporated herein by reference).
10.43	Base Capped Call Confirmation, dated December 6, 2016, between Zillow Group, Inc. and Goldman, Sachs & Co. (Filed as Exhibit 10.2 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on December 12, 2016, and incorporated herein by reference).
10.44	Base Capped Call Confirmation, dated December 6, 2016, between Zillow Group, Inc. and Bank of America, N.A. (Filed as Exhibit 10.3 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on December 12, 2016, and incorporated herein by reference).
10.45	Additional Capped Call Confirmation, dated December 8, 2016, between Zillow Group, Inc. and Citigroup Global Markets Inc. (Filed as Exhibit 10.4 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on December 12, 2016, and incorporated herein by reference).
10.46	Additional Capped Call Confirmation, dated December 8, 2016, between Zillow Group, Inc. and Goldman, Sachs & Co. (Filed as Exhibit 10.5 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on December 12, 2016, and incorporated herein by reference).
10.47	Additional Capped Call Confirmation, dated December 8, 2016, between Zillow Group, Inc. and Bank of America, N.A. (Filed as Exhibit 10.6 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on December 12, 2016, and incorporated herein by reference).
10.48	Zillow, Inc. Proprietary Rights Agreement (Filed as Exhibit 10.1 to Zillow, Inc.'s Form 10-Q filed with the Securities and Exchange Commission on May 8, 2018, and incorporated herein by reference).
10.49	Base Capped Call Confirmation, dated June 28, 2018, between Zillow Group, Inc. and Goldman Sachs & Co. LLC (Filed as Exhibit 10.1 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on July 3, 2018, and incorporated herein by reference).
10.50	Base Capped Call Confirmation, dated June 28, 2018, between Zillow Group, Inc. and Citibank, N.A. (Filed as Exhibit 10.2 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on July 3, 2018, and incorporated herein by reference).
10.51	Base Capped Call Confirmation, dated June 28, 2018, between Zillow Group, Inc. and Royal Bank of Canada, represented by RBC Capital Markets, LLC as its agent (Filed as Exhibit 10.3 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on July 3, 2018, and incorporated herein by reference).
10.52	Base Capped Call Confirmation, dated June 28, 2018, between Zillow Group, Inc. and Bank of America N.A. (Filed as Exhibit 10.4 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on July 3, 2018, and incorporated herein by reference).

<u>Exhibit Number</u>	<u>Description</u>
10.53	Additional Capped Call Confirmation, dated July 2, 2018, between Zillow Group, Inc. and Goldman Sachs & Co. LLC (Filed as Exhibit 10.5 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on July 3, 2018, and incorporated herein by reference).
10.54	Additional Capped Call Confirmation, dated July 2, 2018, between Zillow Group, Inc. and Citibank, N.A. (Filed as Exhibit 10.6 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on July 3, 2018, and incorporated herein by reference).
10.55	Additional Capped Call Confirmation, dated July 2, 2018, between Zillow Group, Inc. and Royal Bank of Canada, represented by RBC Capital Markets, LLC as its agent (Filed as Exhibit 10.7 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on July 3, 2018, and incorporated herein by reference).
10.56	Additional Capped Call Confirmation, dated July 2, 2018, between Zillow Group, Inc. and Bank of America, N.A. (Filed as Exhibit 10.8 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on July 3, 2018, and incorporated herein by reference).
10.57*	Executive Employment and Retirement Agreement and Release, dated May 3, 2018, between Zillow Group, Inc. and Kathleen Philips (Filed as Exhibit 10.2 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on May 7, 2018, and incorporated herein by reference).
10.58*	Executive Severance Agreement and Release, dated October 16, 2018, between Zillow Group, Inc. and Amy Bohutinsky (Filed as Exhibit 10.1 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on October 17, 2018, and incorporated herein by reference).
10.59*	Executive Employment Agreement, dated November 6, 2018, between Zillow Group, Inc. and Allen Parker (Filed as Exhibit 10.1 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on November 6, 2018, and incorporated herein by reference).
10.60*	Amended and Restated Executive Employment Agreement, dated November 13, 2018, between Zillow Group, Inc. and Allen Parker (Filed as Exhibit 10.1 to Zillow Group, Inc.'s Current Report on Form 8-K filed with the Securities and Exchange Commission on November 14, 2018, and incorporated herein by reference).
16.1	Letter of Ernst & Young LLP, dated August 4, 2016 (Filed as Exhibit 16.1 to Registrant's Current Report on Form 8-K filed with the Securities and Exchange Commission on August 4, 2016, and incorporated herein by reference).
16.2	Letter of Ernst & Young LLP, dated February 7, 2017 (Filed as Exhibit 16.1 to Registrant's Current Report on Form 8-K/A filed with the Securities and Exchange Commission on February 10, 2017, and incorporated herein by reference).
21.1	Subsidiaries of Zillow Group, Inc.
23.1	Consent of independent registered public accounting firm.
23.2	Consent of Ernst & Young LLP, independent registered public accounting firm.
31.1	Certification of Chief Executive Officer pursuant to Rule 13-14(a) of the Securities Exchange Act of 1934 as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
31.2	Certification of Chief Financial Officer pursuant to Rule 13-14(a) of the Securities Exchange Act of 1934 as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
32.1	Certification of Chief Executive Officer Pursuant to 18 U.S.C. Section 1350 as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
32.2	Certification of Chief Financial Officer Pursuant to 18 U.S.C. Section 1350 as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
101.INS	XBRL Instance Document.
101.SCH	XBRL Taxonomy Extension Schema Document.
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document.
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document.

<u>Exhibit Number</u>	<u>Description</u>
101.LAB	XBRL Taxonomy Extension Label Linkbase Document.
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document.
*	Indicates a management contract or compensatory plan or arrangement.
+	Schedules omitted pursuant to Item 601(b)(2) of Regulation S-K. Zillow Group agrees to furnish a supplemental copy of any omitted schedule to the Securities and Exchange Commission upon request.

**Item 16. Form 10-K Summary.**

None.

**SIGNATURES**

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

ZILLOW GROUP, INC.

Date: February 21, 2019

By: /s/ JENNIFER ROCK

Name: **Jennifer Rock**

Title: Chief Accounting Officer

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities indicated below on February 21, 2019.

<u>Signature</u>	<u>Title</u>
<u>/s/ SPENCER M. RASCOFF</u> <b>Spencer M. Rascoff</b>	Chief Executive Officer (Principal Executive Officer) and Director
<u>/s/ ALLEN PARKER</u> <b>Allen Parker</b>	Chief Financial Officer (Principal Financial Officer)
<u>/s/ JENNIFER ROCK</u> <b>Jennifer Rock</b>	Chief Accounting Officer (Principal Accounting Officer)
<u>/s/ RICHARD BARTON</u> <b>Richard Barton</b>	Executive Chairman and Director
<u>/s/ LLOYD D. FRINK</u> <b>Lloyd D. Frink</b>	Vice Chairman, President and Director
<u>/s/ ERIK BLACHFORD</u> <b>Erik Blachford</b>	Director
<u>/s/ APRIL UNDERWOOD</u> <b>April Underwood</b>	Director
<u>/s/ JAY C. HOAG</u> <b>Jay C. Hoag</b>	Director
<u>/s/ GREGORY B. MAFFEI</u> <b>Gregory B. Maffei</b>	Director
<u>/s/ GORDON STEPHENSON</u> <b>Gordon Stephenson</b>	Director
<u>/s/ AMY BOHUTINSKY</u> <b>Amy Bohutinsky</b>	Director



---

## Board of Directors

**Richard N. Barton**

Co-Founder and Chief Executive Officer,  
Zillow Group, Inc.

**Lloyd D. Frink**

Co-Founder, Executive Chairman  
and President,  
Zillow Group, Inc.

**Spencer M. Rascoff**

Co-Founder and Former  
Chief Executive Officer,  
Zillow Group, Inc.

**Erik Blachford** <sup>1, 2, 3</sup>

Venture Partner,  
TCV

**Jay C. Hoag** <sup>2</sup>

General Partner,  
TCV

**Gordon Stephenson** <sup>1, 3</sup>

Co-Founder and Managing Broker,  
Real Property Associates

**Amy C. Bohutinsky**

Former Chief Operating Officer,  
Zillow Group, Inc.

**Gregory B. Maffei** <sup>1</sup>

President and Chief Executive  
Officer,  
Liberty Media Corporation

**April Underwood** <sup>2</sup>

Founding Partner,  
#Angels

**Board Committees**

<sup>1</sup> Audit Committee

<sup>2</sup> Compensation Committee

<sup>3</sup> Nominating and Governance Committee

---

## Executive Team

**Richard N. Barton**

Co-Founder and Chief Executive Officer

**Lloyd D. Frink**

Co-Founder, Executive Chairman  
and President

**David A. Beitel**

Chief Technology Officer

**Stanley B. Humphries**

Chief Analytics Officer

**Aimee Johnson**

Chief Marketing Officer

**Dawn Lyon**

Chief Corporate Relations Officer

**Bradley D. Owens**

General Counsel and Secretary

**Allen W. Parker**

Chief Financial Officer

**Arik Y. Prawer**

President, Homes Division

**Jennifer A. Rock**

Chief Accounting Officer

**Errol G. Samuelson**

Chief Industry Development Officer

**Greg M. Schwartz**

President, Media and Marketplaces

**Dan Spaulding**

Chief People Officer

**Jeremy Wacksman**

President, Zillow Brand

---

## Shareholder Information

**Annual Shareholder Meeting**

June 4, 2019 | 9:00 a.m.  
Offices of Perkins Coie LLP  
1201 Third Avenue  
49th Floor  
Seattle, Washington 98101

**NASDAQ Listing**

Class A common stock symbol - ZG  
Class C capital stock symbol - Z

**Investor Relations**

ir@zillowgroup.com

**Transfer Agent**

Computershare  
P.O. Box 505000  
Louisville, KY 40233  
(866) 641-4276

**Corporate Headquarters**

1301 Second Avenue, Floor 31  
Seattle, Washington 98101  
www.zillowgroup.com

**Independent Accountants**

Deloitte & Touche LLP  
Seattle, Washington

**ZILLOW<sup>®</sup>**GROUP



 **Zillow**Offers

 **Zillow**HomeLoans

 **Zillow** PREMIER AGENT

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 **StreetEasy<sup>®</sup>**

 **hotpads<sup>®</sup>**

 **RealEstate.com**

**n★kedapartments**

**out east**

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dot  loop.

 **MORTECH<sup>®</sup>**

# **EXHIBIT 2**

(12) **United States Patent**  
**Biebesheimer et al.**

(10) **Patent No.:** **US 6,778,193 B2**  
(45) **Date of Patent:** **Aug. 17, 2004**

(54) **CUSTOMER SELF SERVICE ICONIC  
INTERFACE FOR PORTAL ENTRY AND  
SEARCH SPECIFICATION**

(List continued on next page.)

#### OTHER PUBLICATIONS

(75) Inventors: **Debra L. Biebesheimer**, Carmel, NY (US); **Donn P. Jasura**, Staatsburg, NY (US); **Neal M. Keller**, Somers, NY (US); **Daniel A. Oblinger**, New York, NY (US); **Mark E. Podlaseck**, New Preston, CT (US); **Stephen J. Rolando**, Katonah, NY (US)

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(List continued on next page.)

(73) Assignee: **International Business Machines Corporation**, Armonk, NY (US)

*Primary Examiner*—Steven Sax

(74) *Attorney, Agent, or Firm*—Scully, Scott, Murphy & Presser; Daniel P. Morris, Esq.

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 625 days.

#### (57) ABSTRACT

A graphical user interface for a customer self service system that performs resource search and selection. The interface comprises an entry field enabling entry of a query for a resource and selection of one or more user context icons, each representing a context associated with the current user situation, and having context attributes associated therewith; a first visual workspace is provided for visualizing and exploring the set of resources that the customer self service system has determined to match the user's query, the system indicating a degree of fit of the determined resources with the query, based on the user's context, associated resource selection parameters and associated relevant resource evaluation criteria utilized by a search mechanism in the system; and, a second visual workspace including detail specification workspace for enabling user to select and modify user context attribute values and further relevant resource evaluation criteria; and a mechanism for enabling the user to continuously navigate among the first and second visual workspaces to enable increased specificity and accuracy of query's search parameters and resource evaluation criteria and thereby identify and improve selection logic and response sets fitted to a query. The graphical user interface permits user interactivity for querying a customer self service system and enhancing response set results for a variety of self service domains including education, real estate and travel.

(21) Appl. No.: **09/778,136**

(22) Filed: **Feb. 7, 2001**

#### (65) Prior Publication Data

US 2002/0149614 A1 Oct. 17, 2002

(51) **Int. Cl.<sup>7</sup>** ..... **G06F 15/00**

(52) **U.S. Cl.** ..... **345/805; 345/854**

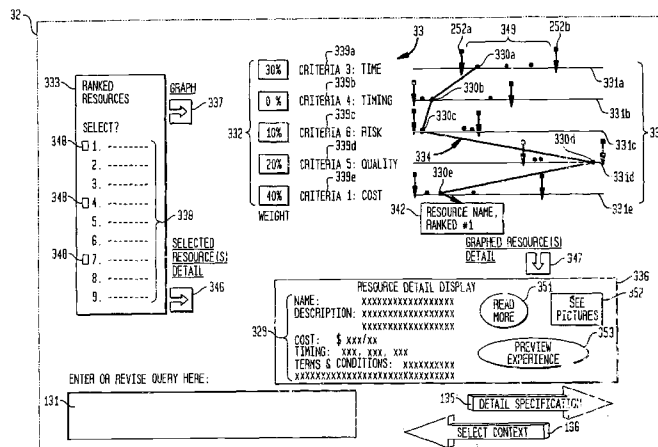
(58) **Field of Search** ..... 345/853-855,  
345/711, 802, 803, 804, 805, 799, 800,  
801, 795-797, 738, 734-737, 771-773,  
811, 815-818; 707/1, 10, 11, 5, 3; 706/60,  
11, 47, 45

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**17 Claims, 9 Drawing Sheets**



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FIG. 1

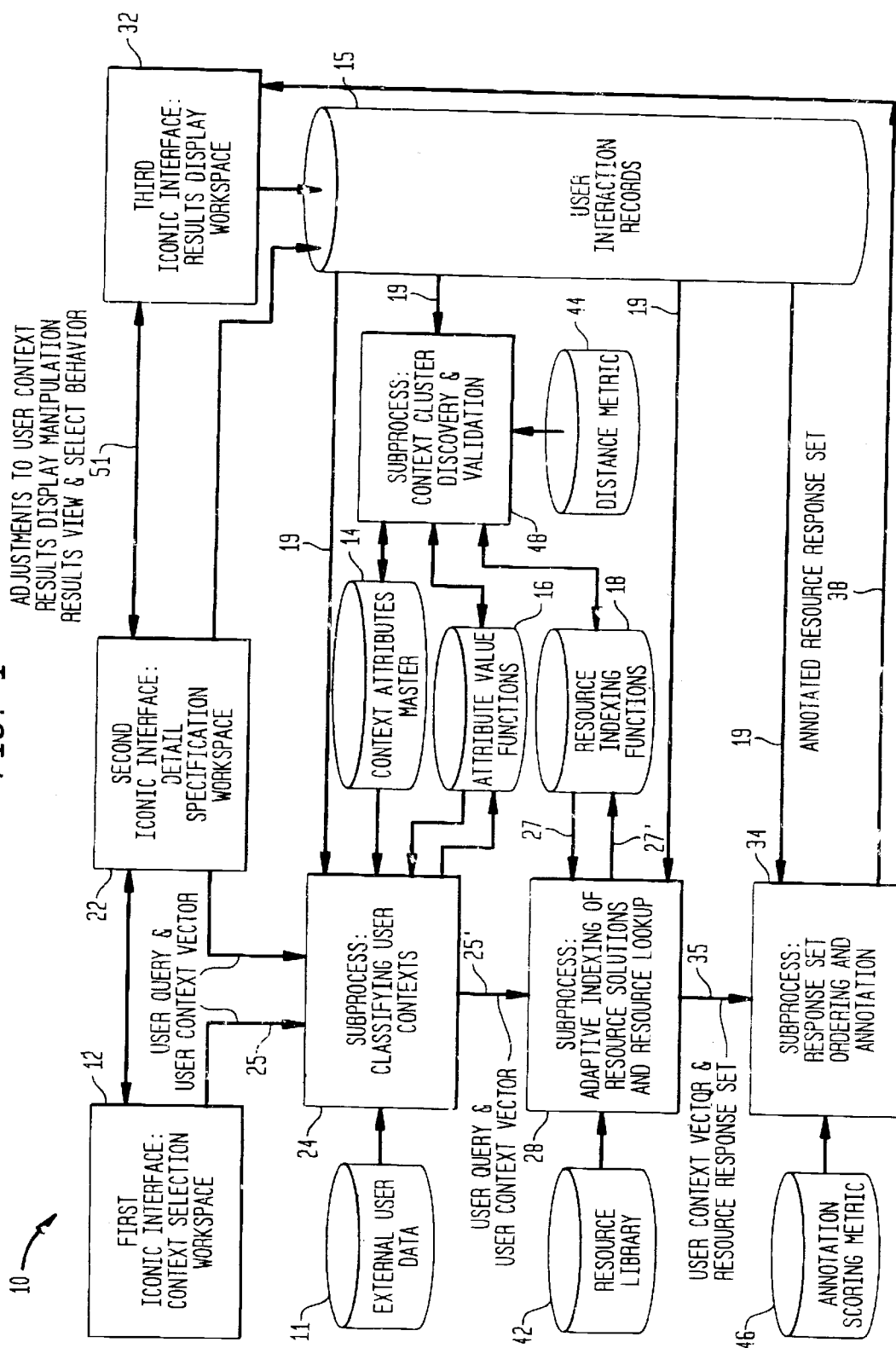
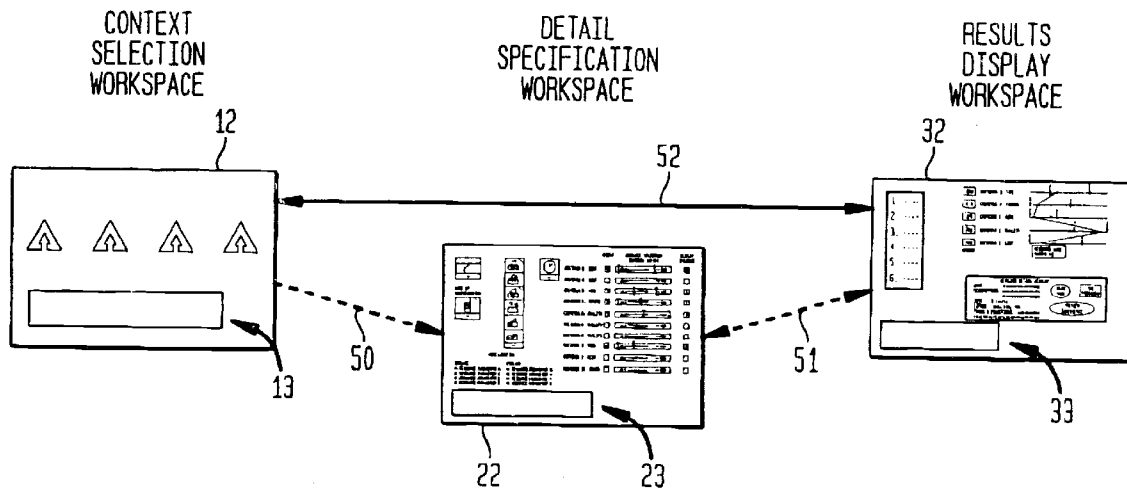




FIG. 2



U.S. Patent

Aug. 17, 2004

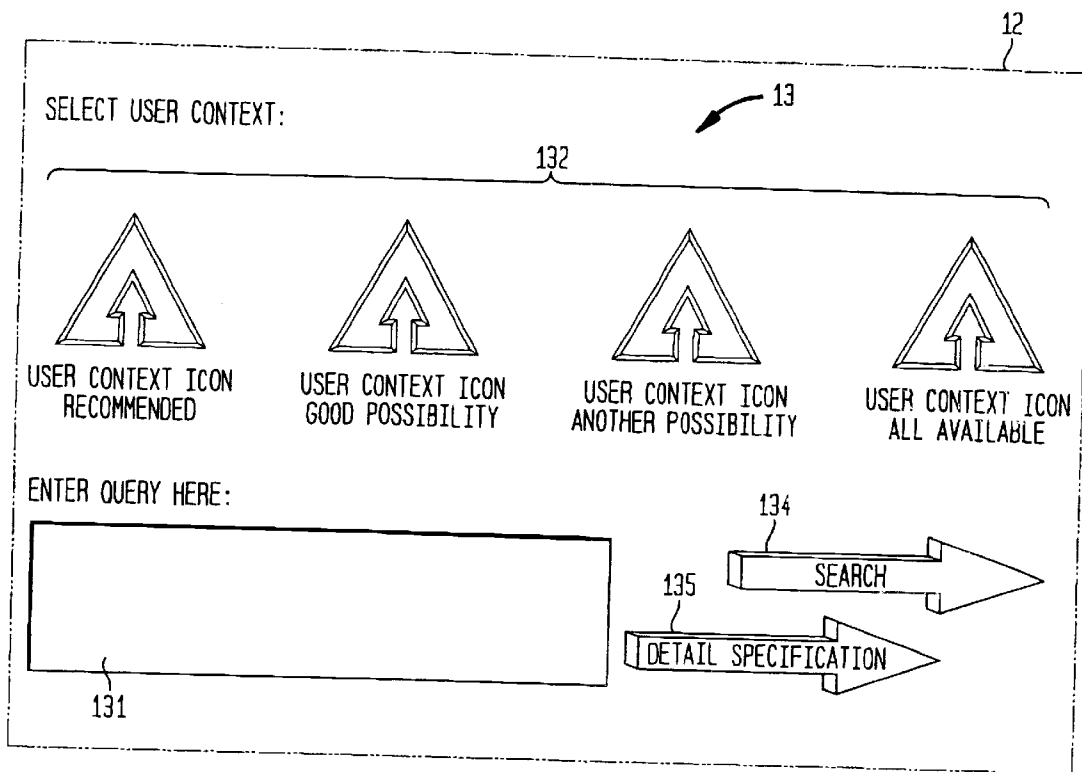
Sheet 3 of 9

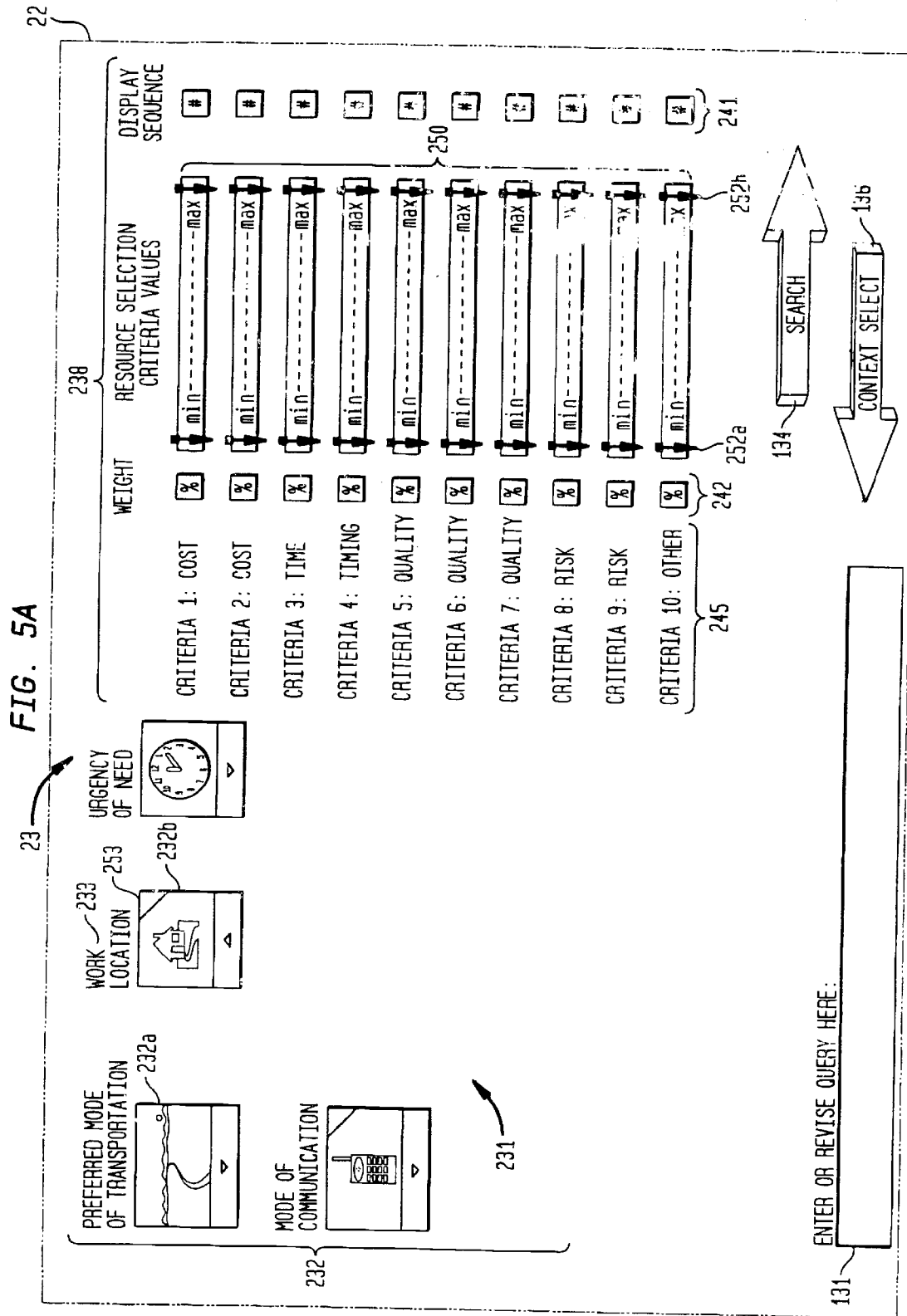
US 6,778,193 B2

FIG. 3

	EDUCATION (EX: ENVIRONMENT)	EDUCATION (EX: SUBJECT MATTER)	REAL ESTATE	THAVE
	60	70	80	90
USER QUERY	LEARN LOTUS NOTES AT HOME 61	BECOME A LINUX DEVELOPER BY JUNE 71	FIND HOUSING NEAR NEW JOB BY AUGUST 81	PLAN A TRIP TO VERMONT IN JUNE 91
USER CONTEXT	CORP EXEC AT HQ REMOTE STAFFIE COMMUTING TECHIE TRAVELING CONSULTANT 62	CORP EXEC AT HQ REMOTE STAFFIE COMMUTING TECHIE TRAVELING CONSULTANT 72	RELOCATING BUSINESS PROFESSIONAL EMPTY NESTER COLLEGE STUDENT 82	SINGLE MOM W/KIDS SWINGING SINGLES BUSINESS TRAVELER 92
CONTEXT ATTRIBUTE	CONNECTIVITY LEARNING MODE(S) TECHNICAL FIELD 63	CONNECTIVITY LEARNING MODE(S) TECHNICAL FIELD 73	MODE OF COMMUTE TO WORK/SCHOOL MODE OF HOUSING MAINTENANCE STYLE 83	MODE OF TRANSPORTATION MODE OF HOUSING FOOD STYLE 93
ATTRIBUTE VALUE	LAN CONNECTED DIAL UP DSL DISCONNECTED 64	SECURITY GRAPHICAL INTERFACES PROGRAMMING SYSTEMS INTEGRATION 74	CAREFREE LIVING SUBCONTRACT IT ALL DO-IT-YOURSELF-ER 84	DRIVE FLY TRAIN 94
VALUE RESOURCE PARAMETERS	INCLUDE: DOWNLOAD & PLAY RESOURCES ----- EXCLUDE: ON LINE COLLABORATIVE RESOURCES 65	INCLUDE KDE ----- EXCLUDE GNOME 75	INCLUDE WALLS INCLUDE PAINT INCLUDE LAWN MOWING ----- EXCLUDE PLUMBING EXCLUDE ELECTRICAL EXCLUDE LANDSCAPING 85	INCLUDE ALL MAJOR CARRIERS ----- EXCLUDE PROP PLANES EXCLUDE BAD SAFETY RECORDS 95
RESOURCE SELECTION CRITERIA & VALUES	COST TIME QUALITY RISK 66	COST TIME QUALITY RISK 76	COST TIME QUALITY RISK 86	COST TIME QUALITY RISK 96

FIG. 4





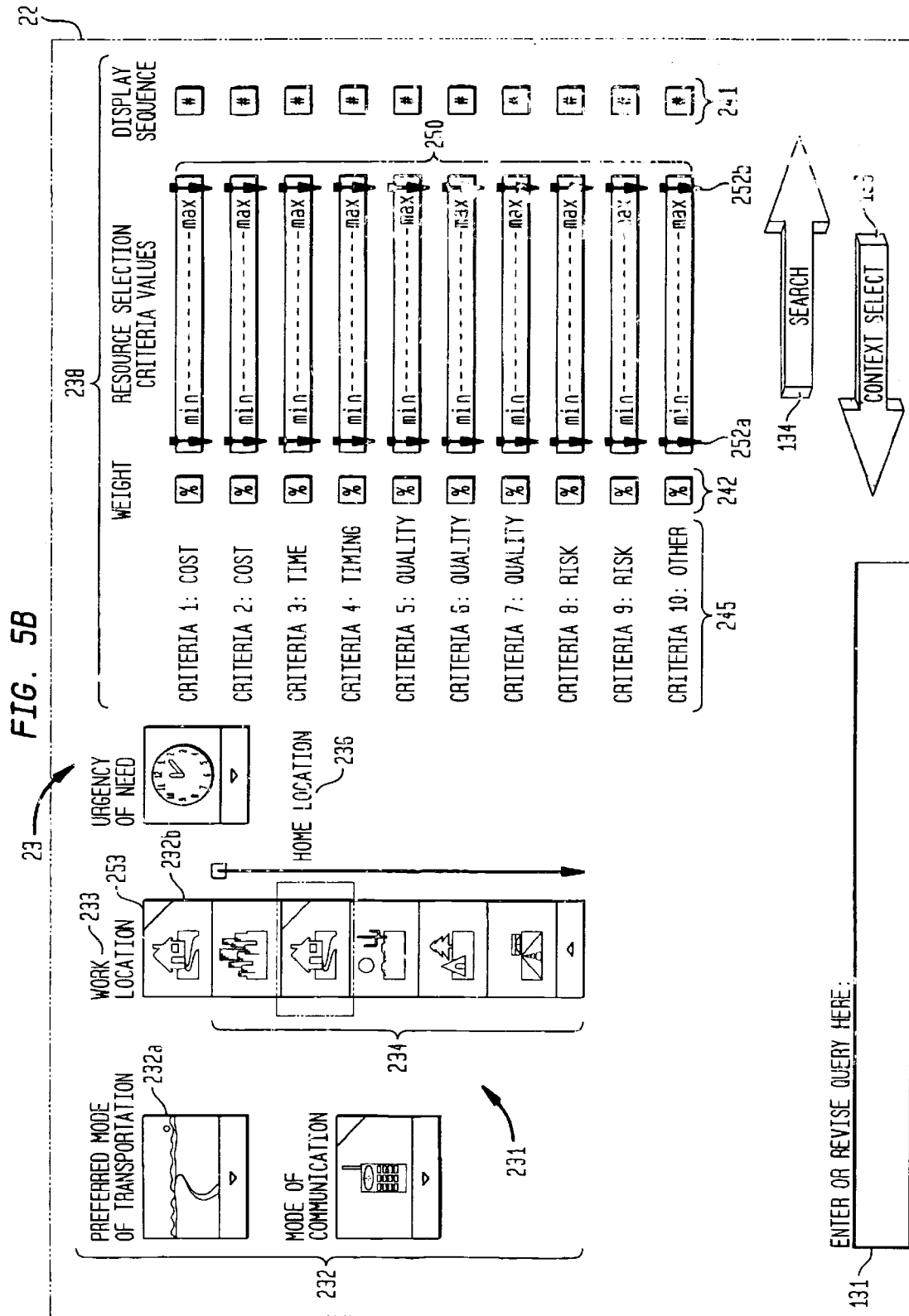


FIG. 5C

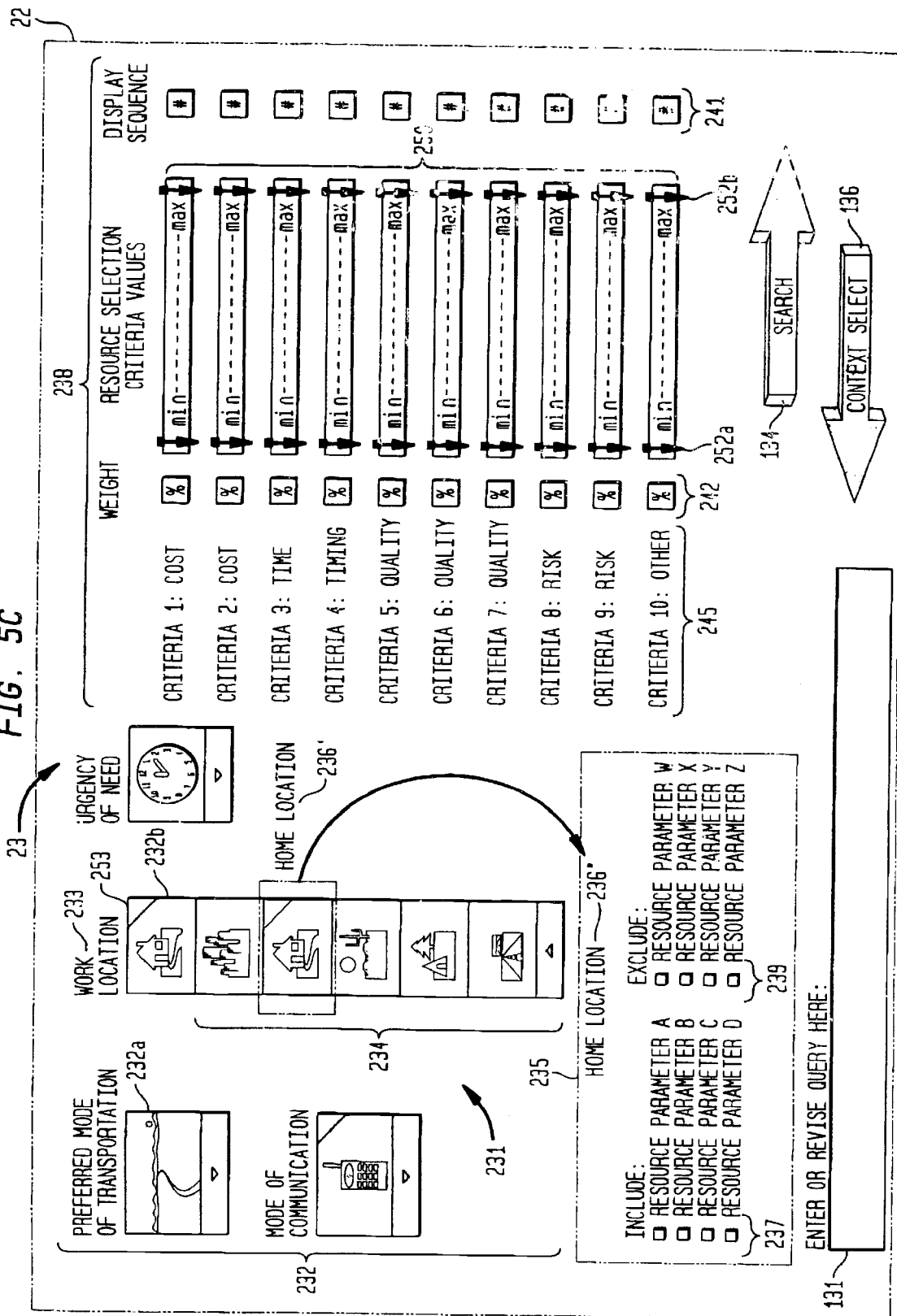
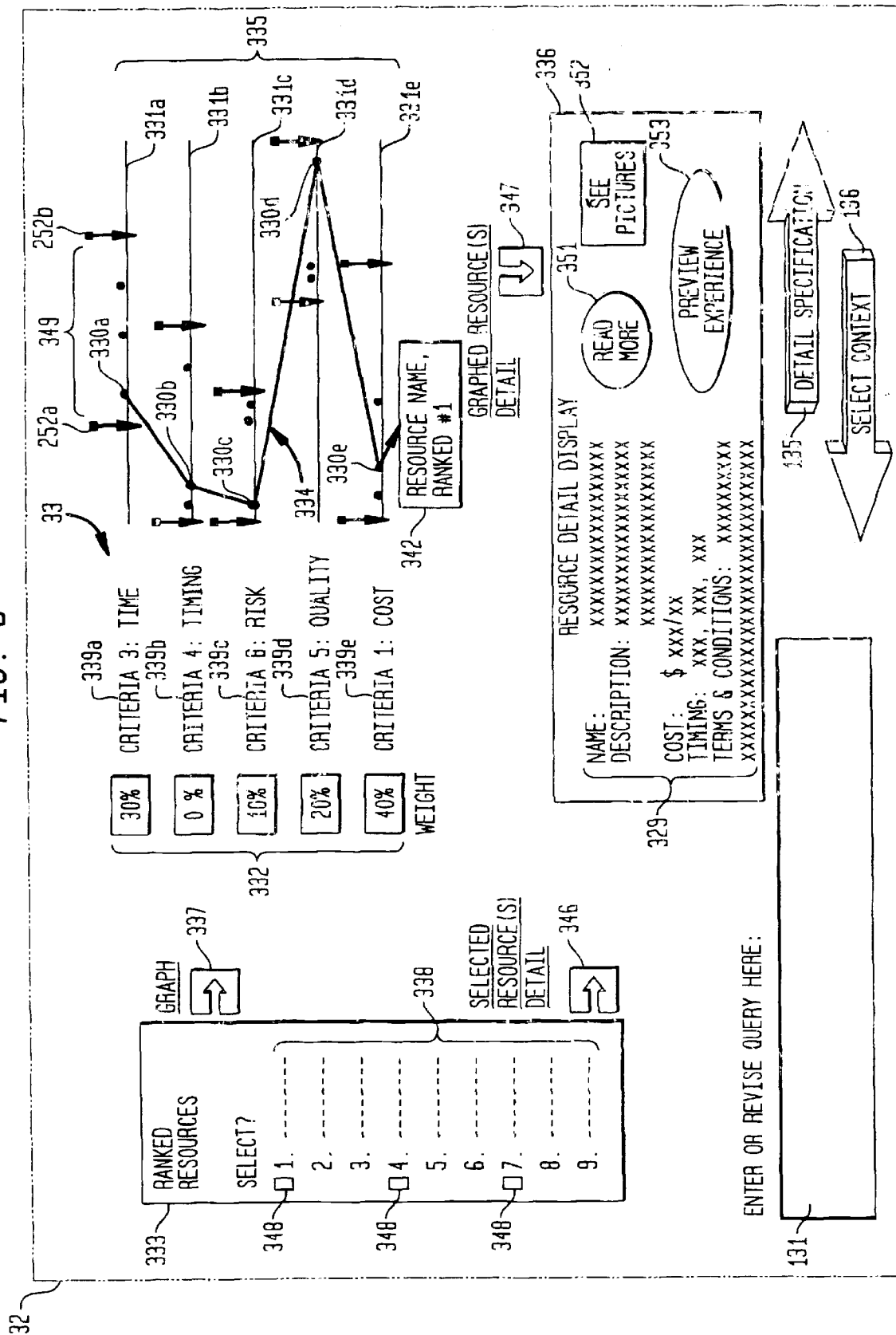






FIG. 6



US 6,778,193 B2

1

# CUSTOMER SELF SERVICE ICONIC INTERFACE FOR PORTAL ENTRY AND SEARCH SPECIFICATION

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

This invention relates generally to the field of customer self service systems for resource search and selection, and more specifically, to a novel graphical user interface for such a system.

### 2. Discussion of the Prior Art

Currently there exist many systems designed to perform search and retrieval functions. These systems may be classified variously as knowledge management systems, information portals, search engines, data miners, etc. Providing effective customer self service systems for resource search and selection presents several significant challenges. The first challenge for current systems with query capability is that serving queries intelligently requires a large amount of user supplied contextual information, while at the same time the user has limited time, patience, ability and interest to provide it. The second challenge is that searching without sufficient context results in a very inefficient search (both user time and system resource intensive) with frequently disappointing results (overwhelming amount of information, high percentage of irrelevant information). The third challenge is that much of a user's actual use and satisfaction with search results differ from that defined at the start of the search: either because the users behave contrary to their own specifications, or because there are other contextual issues at play that have not been defined into the search.

Graphical user interfaces (GUIs) provide ways for users of computers and other devices to effectively communicate with the computer. In GUIs, available applications and data sets are often represented by icons consisting of small graphical representations which can be selected by a user and moved on the screen. The selection of icons often takes the place of typing in a command using a keyboard in order to initiate a program. In general, icons are tiny on-screen symbols that simplify functions like the access to a program, command, or data file. Icons are usually activated or selected by moving a mouse-controlled cursor onto the icon and pressing the mouse button.

GUIs for customer self service systems for resource search and selection have the potential to enable users to efficiently enter large amounts of contextual information. The prior art has addressed a 1:1 correspondence between a limited range of contextual variables and icons. A major limitation of these approaches is that they fail to address the full range of relevant user contextual variables as part of the query and require extensive time and patience on the part of the user to make even limited contextual selections. Another limitation of these approaches is that they fail to provide for a graphical method of fine tuning the context variables relevant to the user's search, focusing only on the fine tuning of the content variables.

As will be hereinafter explained in greater detail, some representative prior art search and retrieval systems implementing novel user interfaces include U.S. Pat. No. 5,303,361 entitled "Search and Retrieval System"; U.S. Pat. No. 5,608,899 entitled "Method and Apparatus for Searching a Database by Interactively Modifying a Database Query"; U.S. Pat. No. 5,768,578 entitled "User Interface for Information Retrieval System"; U.S. Pat. No. 5,841,437 entitled "Method and Apparatus for Interactive Database Queries via

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Movable Viewing Operation Regions"; U.S. Pat. No. 5,918,217 entitled "User Interface for a Financial Advisory System"; U.S. Pat. No. 5,930,501 entitled "Pictorial User Interface for Establishing Time of Day and Geographical or Environmental Context on a Computer Display or Other Monitor".

U.S. Pat. No. 5,303,361 describes a text search and retrieval system which builds an index representing every word in stored files created by a variety of applications, searches for requested words using the index, ranks the files based on the relative strength of match with the search request and displays the ranked filenames for user selection.

U.S. Pat. No. 5,608,899 describes an apparatus for searching a database and modifying database queries including an approach to searching multidimensional data, e.g., by constructing a query from a sequential process of identifying constraints from bar, line, and pie charts.

U.S. Pat. No. 5,768,578 describes an information retrieval system user interface for retrieving information from a plurality of sources and for storing information source descriptions in a knowledge base. The user interface includes a hypertext browser enabling a user to browse an unstructured information space and, a knowledge base browser/editor for displaying a directed graph representing a generalization taxonomy of the knowledge base, with the nodes representing concepts and edges representing relationships between concepts. The system also allows for querying a structured information source and using query results to focus the hypertext browser on the most relevant unstructured data sources.

U.S. Pat. No. 5,841,437 describes an information visualization system that uses dynamic queries in combination with movable viewing operation regions for searching of two dimensional databases.

U.S. Pat. No. 5,918,217 describes a user interface for a financial advisory system in which a user may interactively explore how changes in one or more input decisions such as a risk tolerance, a savings level, and a retirement age affect one or more output values such as a probability of achieving a financial goal or an indication of short-term risk. Although it deals exclusively with financial systems, the concept of enabling interactive exploration of a multidimensional data set is described.

U.S. Pat. No. 5,930,501 describes a system for retrieving and displaying a pictorial user interface on a computer display or other monitor and addresses the issue of a single context variable with a pictorial approach.

It would be highly desirable to provide a graphical user interface for a customer self service resource search and selection system that is capable of addressing multiple context variables abstractly, using an interactive information graphic.

Representative prior art references addressing the issue of providing some element of context to search and retrieval systems includes U.S. Pat. No. 5,794,178 entitled "Visualization of Information Using Graphical Representations of Context Vector Based Relationships and Attributes"; U.S. Pat. No. 6,014,661 entitled "System and Method for Automatic Analysis of Data Bases and for User-Controlled Dynamic Querying"; U.S. Pat. No. 6,097,386 entitled "Data Processing System Having Context Sensitive Visual Feedback for User Interface Controls and Method Therefor".

Particularly, U.S. Pat. No. 5,794,178 describes a system and method for automatically generating context vectors representing conceptual relationships among information items by quantitative means for use in storage and retrieval

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of documents and other information items and for displaying them visually to a user. A neural network operates on a training corpus of records to develop relationship-based context vectors based on word proximity and co-importance using a technique of "windowed co-occurrence". Relationships among context vectors are deterministic, so that a context vector set has one logical solution, although it may have a plurality of physical solutions. No human knowledge, knowledge base, or conceptual hierarchy, is required. Summary vectors of records may be clustered to reduce searching time, by forming a tree of clustered nodes. Once the context vectors are determined, records may be retrieved using a query interface that allows a user to specify content terms, Boolean terms, and/or document feedback. Thus, context vectors are translated into visual and graphical representations to thereby provide user visualization of textual information and enable visual representations of meaning so that users may apply human pattern recognition skills to document searches.

U.S. Pat. No. 6,014,661 describes a system that utilizes user-adjusted relevance criteria to generate a query. It is primarily directed to a main processing system that accesses a database, which contains data records, each of which is divided into data fields. The system preferably automatically determines the type of data in each field, as well as its range of values. It then determines one or more relational structures of the field data using a corresponding number of relevance measures. For each field, a preferably user-adjustable, software-generated query device is displayed, preferably in the order of the relevance measures of the respective fields. The plot of one or more fields' data relative to that of another field is initially generated using the fields in order of relevance. The relevance measure forming the basis of the field ordering, the order of fields, and the ranges of the plotted, displayed fields may be adjusted interactively by the user by moving and adjusting the various query devices.

U.S. Pat. No. 6,097,386 is directed to a data processing system that transforms the limited user interface toolkits currently in use in the software development industry to provide control interfaces which are sensitive to a user's operational context.

Thus, the prior art has addressed the issues of database searching, dynamic query formulation, and the visual representation of multidimensional data. Newer search engines are just beginning to use some of these ideas to express queries and results. There has heretofore never been an information search and retrieval method providing the means to express the relevance of the results to a particular user in terms beyond that of the results' content.

It would be highly desirable to provide in a customer self service system, an interface that facilitates the efficient location of relevant resources by the busy user by enabling the expression of a user's context as part of the query, and the relevance of the results to that context.

More specifically, it would be highly desirable to provide in a customer self service system, an intuitive graphical user interface that provides elements to enter search terms, select and fine tune user context definitions from pull-down menus as part of the query, establish inclusionary and exclusionary resource filters, and specify resource priorities by selecting, sequencing and weighting relevant criteria.

#### SUMMARY OF THE INVENTION

It is an object of the present invention to provide an intuitive graphical user interface for a customer self service system enabling resource search and selection.

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It is a further object of the present invention to provide an intuitive graphical user interface for a customer self service system, wherein the GUI provides elements to enter search terms, select and fine tune user context definitions.

It is yet another object of the present invention to provide an intuitive graphical user interface for a customer self service system, wherein the GUI enables establishment of inclusionary and exclusionary resource filters, and enables the specification of resource priorities by selecting, sequencing and weighting relevant criteria.

The GUI described by this invention facilitates the efficient location of relevant resources by the user because it enables the expression of a user's context as part of the query.

According to the invention, there is provided a graphical user interface for a customer self service system that performs resource search and selection. The interface comprises a first visual workspace comprising entry field enabling entry of a query for a resource and, one or more selectable user context icons, each representing a context associated with the current user situation, and having context attributes associated therewith; a second visual workspace for visualizing and exploring the set of resources that the customer self service system has determined to match the user's query, the system indicating a degree of fit of the determined resources with the query, based on the user's context, associated resource selection parameters and associated relevant resource evaluation criteria utilized by a search mechanism in the system; a third visual workspace including detail specification workspace for enabling user to select and modify user context attribute values, and further relevant resource evaluation criteria; and visual means enabling the user to continuously navigate among the first, second and third visual workspaces to enable increased specificity and accuracy of query's search parameters and resource evaluation criteria and thereby identify and improve selection logic and response sets fitted to a query.

Advantageously, such a customer self service system is applicable to a variety of customer self service domains including, but not limited to: education, real estate and travel.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Further features, aspects and advantages of the apparatus and methods of the present invention will become better understood with regard to the following description, appended claims, and the accompanying drawings where:

FIG. 1 is a flowchart showing the steps of the control flow between the component inventions included in the generic preferred embodiment of the system invention.

FIG. 2 is a flowchart showing the generic process steps of the user's interaction with the customer self service system through the iconic interfaces of the preferred embodiment of the invention.

FIG. 3 provides examples of data elements from the education, real estate and travel domains given example user interactions with the customer self service system via the iconic interfaces of the invention.

FIG. 4 illustrates the first Graphical User Interface 12 providing a Context Selection Workspace 13 for enabling entry of query and context selection according to the invention.

FIGS. 5(a)–5(d) illustrate in detail the second iconic graphical user interface 22 including the Detail Specification Workspace 23 according to the invention.



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FIG. 6 illustrates in detail the third iconic graphical user interface 32 including the Results Display Workspace 33.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a customer self service system ("system") 10 which is described in detail commonly-owned, co-pending U.S. patent application Ser. No. 09/778,146 entitled CUSTOMER SELF SERVICE SYSTEM FOR RESOURCE SEARCH AND SELECTION the contents and disclosure of which are incorporated by reference as if fully set forth herein. The system 10 is a comprehensive self service system providing an end-to-end solution that integrates the user and system, the content and context, and, the search and result so that the system may learn from each and all users and operationally benefit all users over time. The present invention particularly comprises a graphical user interface (GUI) that is iconic, and enables users to enter queries and manipulate the detailed specifications which drive the selection of resources by the system.

Particularly, as shown in FIG. 1, the self service system provides a three-part intuitive iconic interface comprising interface components 12, 22 and 32 for visualizing and exploring the set of resources that the system has found to match the user's initial query and related subject and context variables. The system 10 preferably enables the expression of a user's context as part of the query and expresses the relevance of the results to a particular user via the interface in terms beyond that of the results' content. The resource set is presented to the user in a way which clearly illustrates their degree of fit with the user's most important context variables, as indicated by their prior usage of the system, as well as by context choices for the current query. The system displays the resources in the sequence specified by the user and enables the user to select and weight the criteria to be used in interpreting and selecting between resources. This provides a shifting of the user's focus from finding something, to making choices among the set of resources available. Via the interface components 12, 22 and 32, the user may redefine their query, preview some or all of the suggested resources or further reduce, and redisplay the response set to extract those with the best degree of fit with that user's current needs. The system generates and displays via the interface a listing of the currently active inclusionary and exclusionary content filters and provides a means for modifying them. More specifically, the intuitive user interface of the invention enables users to specify the variables of their resource needs.

FIG. 2 particularly depicts reduced-size displays illustrating the three iconic user interfaces 12, 22, 32 which comprise the respective workspaces according to the invention. As will be described in greater detail herein, the first graphical user interface 12 comprises an initial Context Selection Workspace 13 that enables the expression of user context as part of a query in a manner optimized for ease of use; the graphical user interface 22 shown in FIG. 2 provides a Detailed Specification Workspace 23 including a visual representation of multi-dimensional data for expressing query and results that enables users to completely manage their search in a manner optimized for simplicity and clarity of logic; and, the graphical user interface 32 is directed to a Results Display Workspace 33 that enables expression of relevance of results in terms of user context in a manner optimized to facilitate resource selection using user supplied decision criteria. Aspects of interfaces 12, 22 and 32 shown in FIG. 2 according to the invention are described in greater detail herein and additionally in commonly-owned,

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co-pending U.S. patent application Ser. No. 09/778,147 entitled CUSTOMER SELF SERVICE ICONIC INTERFACE FOR RESOURCE SEARCH RESULTS DISPLAY AND SELECTION the contents and disclosure of which are incorporated by reference as if fully set forth herein.

Referring back to FIG. 1, there is depicted a conceptual control flow 10 for the customer self service resource search and selection system according to a preferred embodiment. Via the three-part intuitive graphic user interface (GUI) users are enabled to enter queries and manipulate the system's responses according to their resource needs. Behind the scenes, as will be described, is a set of sub-system components that cooperate to derive, assume, sense and infer particular user contexts with minimal user effort. These components include databases such as: 1) a Context Attributes Master database 14 which stores the definitions of all the attributes known to the system and their relationships to predefined user contexts; 2) an Attribute Value Functions database 16 which stores the definitions and logic associated with assigning a value to an attribute for specific instances (context default, groups of users); 3) a Resource Indexing Functions database 18 which stores the definitions and logic for mapping specific resources to specific context sets; and, 4) a historical User Interaction Records database 15 which stores the users' prior queries, responses, and interactions with the system 10. The first three databases are created before system startup and the User Interaction Records 15 is created with the first user/use of the system, however, it is understood that all four databases are maintained and enhanced through system operations described below. First, prior to a user signing on to the system, and before the user first views the iconic interface 12, the system 10 performs several pre-processing steps including: 1) creating of an empty "user context vector" 25 and populating the context vector with minimal information from external data elements 11 integrated with the system or, from system sensing/discovery; and, 2) processing the minimal user context vector 25 against the Context Attributes database 14, the Attribute Value Functions database 16, and the User Interaction Records database 15 using context classification logic to result in a "suggestion" that this particular user may be classified into one of a small number of user context definitions from the system's predefined long list of context definitions. After these pre-processing steps, the first iconic interface 12 is then displayed for the user at the user's terminal, or web-browser, in the case of resource searches conducted over a web-based communication link. The iconic Context Selection Workspace 13 initially displays a small set of User Context Icons it has determined are most appropriate, captures the user's selection of the one that seems most fitting for the current user search session, and captures the user's actual query. In most cases, this minimal entry will suffice to begin the search because the system has already determined the relevant attributes, default values and parameters to drive the system forward through the user search without any additional entry on the user's part. However, if the user wishes to review their defaults or to fine tune some context or resource variables, there is an option to proceed to the iconic Detailed Specification Workspace display 22 before starting the search. These two workspaces 12, 22 and their iconic elements are described more fully herein.

Regardless of the screen navigation path chosen, when the user initiates the query, the system 10 packages the user query with a detailed User Context Vector 25 summarizing what is known of the user's needs at this point. Once the search is initiated, the query and context vector are pro-

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cessed sequentially through three distinct sub-processes: 1) a Classifying User Contexts sub-process **24**; 2) an Adaptive Indexing of Resource Solutions and Resource Lookup sub-process **28**; and, 3) a Response Set Ordering and Annotation sub-process **34**.

Particularly, the Classifying User Contexts sub-process **24**, receives as input the user query and the raw context vector **25** and External User Data **11**, and processes these against the User Interaction records **19** for this user/user group, data from the Context Attributes Master **14** and Attribute Value Functions **16**. The system classifies this specified user interaction state and annotates the context vector **25'** with a complete set of context parameters for use in subsequent processing. The Classifying User Contexts sub-process **24** particularly applies an inductive learning algorithm as an attempt to predict derived contexts. Additionally, the Classifying User Contexts sub-process **24** updates the Attribute Value Functions database **16** with more enhanced functions. The actual processing via Context Classifier and Context Applier is described in greater detail in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,378 entitled CUSTOMER SELF SERVICE SUBSYSTEM FOR CLASSIFYING USER CONTEXTS the contents and disclosure of which are incorporated by reference as if fully set forth herein.

As the customer self service system is provided with functionality enabling a user to "bookmark" their stopping point in a prior session and to resume with a "work-in-process" data set, the initial settings may be modified based upon system discovery or user override at the time of inquiry, resulting in the raw contexts associated with the user's current inquiry transaction. It is this raw context data which serves as input to the context classifier sub-process **24**.

The Adaptive Indexing of Resource Solutions and Resource Lookup sub-process **28** receives as input the user query and the context vector **25'** and processes them against a Resource Library **42**, the User Interaction Records for this user/user group **19**, and the Resource Indexing Functions **27**. This sub-process particularly maps specific contexts to specific resources so as to increase the relevance of search results for a given user in their current context without requiring the user to explicitly train the system. The primary output of the Adaptive Indexing of Resource Solutions and Resource Lookup sub-process **28** is a newly identified Resource Response Set **35** which is input to the Response Set Ordering and Annotation sub-process **34**. The Adaptive Indexing of Resource Solutions and Resource Lookup sub-process **28** additionally generates a secondary output which comprises updates to the Resource Indexing Functions database **18** with yet more enhanced functions **27'**. Further details regarding the Adaptive Indexing of Resource Solutions and Resource Lookup sub-process **28** may be found in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,135 entitled CUSTOMER SELF SERVICE SUBSYSTEM FOR ADAPTIVE INDEXING OF RESOURCE SOLUTIONS AND RESOURCE LOOKUP, the contents and disclosure of which are incorporated by reference as if fully set forth herein.

The Response Set Ordering and Annotation sub-process **34** receives as input the User Context Vector and Resource Response Set **35** and processes it against data from an Annotation Scoring Metric database **46** and User Interaction Records **19** for the particular user/group. This sub-process **34** weights and ranks the potential responses according to the resource selection criteria specified by the user on the Detailed Specification Workspace described herein, and

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takes into consideration the scoring metric. The sub-process **34** additionally tags the response set with data elements necessary for display and manipulation on a visualization system, including, but not limited to, the Results Display Workspace **32** described in the co-pending U.S. patent application Ser. No. 09/778,147, and particularly generates as output an Annotated Resource Response Set **38**. Further details regarding the Response Set Ordering and Annotation sub-process **34** may be found in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,139 entitled CUSTOMER SELF SERVICE SUBSYSTEM FOR RESPONSE SET ORDERING AND ANNOTATION, the contents and disclosure of which are incorporated by reference as if fully set forth herein.

As mentioned, the ordered and annotated set of resources that the system has found to best match the user's initial query and related subject and context variables may be utilized to drive a visualization system, including but not limited to, the intuitive iconic interface **32** for visualizing and exploring the response set as will be described in greater detail herein. This Results Display Workspace provides an interface that enables the user to continue working to learn about the resources suggested (detail/preview), narrow their results (selection) or redisplay them in a more meaningful view for decision making (graphically). In most instances, that will suffice. However, should the user wish to further refine their query, tune or override their current or default settings, that option is also available by navigating back to the Detailed Specification Workspace interface **22**. If the user needs to start over, including selection of a new user context, it will be necessary to navigate back to the initial Context Selection Workspace **13**.

As the user works with the system, particularly through the Results Display Workspace **32** and the Detail Specification Workspace **22** his/her interactions are captured and stored in the User Interaction Records database **15**. Thus, in addition to the user query, context vector and response data set, the system retains adjustments to user context, results display manipulation, and results viewing and selection behavior **51**.

Having completed the transaction, there is one more sub-process which is essential to this system: the sub-process for Context Cluster Discovery and Validation **48**. This batch process, occurring asynchronously and constantly, applies unsupervised (machine) learning to cluster user interaction records and to assist in the identification of new user contexts, attribute value functions and resource indexing functions. The User Interaction Records **19** are processed against the Context Attributes Master database **14**, the Attribute Value Functions database **16** and the Resource Indexing Functions database **18** and a Distance Metric **44** which helps determine "how close is close", i.e., "what's good enough" for a variety of factors. When validated by a systems administrator, additional user contexts may be implemented (manually or semi-automatically) in the databases and visibly as new icons on the Context Selection Workspace **13**.

Attribute functions may also be identified and resource indexing functions may be discovered and updated in the appropriate files automatically. All of these additional classifications improve the ease of use, accuracy, and predictability of the system over time. Further details regarding the Context Cluster Discovery and Validation sub-process **48** may be found in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,149 entitled CUSTOMER SELF SERVICE SUBSYSTEM FOR CONTEXT CLUSTER DISCOVERY AND VALIDATION, the contents and disclosure of which are incorporated by reference as if fully set forth herein.



The customer self-service system and the interaction with the system through the iconic interfaces of the invention, will be described with respect to example domains such as education, travel and real estate, and further will be described from the point of view of the following users: a learner, a traveler and a real estate transactor, e.g., renter/buyer. In describing the user's interaction with the system through the iconic interfaces, a set of data elements used in the system and their characteristics are first defined as follows:

Query:	an entry field for entering search data by using text or voice methods, for example, but not limited to these methods
User Context:	a User Context represents a predefined set of context attributes which are relevant to the search behavior/needs of a group of people.

More particularly, the User Context enables the packaging of a rich set of attributes about the user with a rich set of attributes about their searching and execution environment in response to "one click" of an icon for the user presented via the interface. While there are potentially a large number of potential user contexts for any user population, each individual user would likely settle on a small number that apply to them in different circumstances. The naming of these contexts is important so that the user may recognize him/herself as potentially fitting into that group. The attributes associated with a particular user context are predefined by system administration and cannot be modified by the user. Over time, the system will identify changes to the attribute set that will make a particular user context perform better for its repeated users. Over time the system will detect different attribute sets which appear to predict user needs/behaviors and might suggest new user contexts for the system.

Context Attribute: An attribute is used to describe a characteristic associated with the User Context. There are potentially an unlimited number of attributes defined to the system with a master list maintained in the Context Attributes Master File. New attributes are discovered and added with system administrator validation. End users may not modify the definition of a context attribute, nor its' packaging into user contexts, nor the list of values associated with each.

Attribute Value: A list of attribute value choices is predefined for each context attribute. The system sets a default value to each attribute based upon data lookup, sensed, or historically derived from prior user entry or behavior. Either the system or the user may modify the value initially set based upon explicit preferences or observed behavior. This value is added to the context vector used for resource lookup, and is retained in the historical User Interaction Records database 15 so it may be used to set default values for each individual each time they use the system.

Value Resource Parameters:	Parameters defined in terms of inclusion and exclusion that may be used as a filter to increase the relevance of the response set.
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That is, with the basic search logic established, the user's query may be satisfied. However, the response set may contain a large number of resources which are not satisfac-

tory to this individual. Value Resource Parameters defined in terms of inclusion and exclusion may be used as a filter to increase the relevance of the response set. The inclusionary parameters may be easier to establish by users new to the system and that exclusionary parameters will become more evident as users gain experience in working with the response sets.

Resource Selection Criteria and Value Ranges:	Parameters and specifications for ranking a user's response set to enable more informed resource selection.
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Thus, even with the degree of specificity enabled by the system, and even with the constant improvement in search relevance/efficiency as it relates to user contexts, there usually may be more than one resource to present to the user (in fact, if the search is too narrow, the user may miss the opportunity to explore/discover different approaches to meeting their actual needs). As most users know (or think they know) the criteria they will apply to selecting between options, a limited set of resource selection criteria are provided by the system (the set would differ by domain). However, via an interactive graphical display provided by the iconic interface of the invention, the user may now specify acceptable value ranges and relative weighting of each criteria for ranking their response set and/or may customize the use of these criteria.

When the actual response set data is offered, most users face the reality of many options, few options, more subjective information about specific resources; and they may make tradeoffs around the selection logic. For example, the response set may be refreshed as the user may decide to eliminate a criteria, change the weight of a criteria, or change the acceptable value ranges for a criteria. From these specifications, accessible via the iconic interface of the invention, the user may determine for example, whether time, timing, flexibility, and risk may be sacrificed in order to bring the cost down below a certain dollar (\$) value, and, for example, determine how much more would the user need to pay to get exactly what he/she wants exactly when he/she wants it.

FIGS. 2, 4, 5(a)–5(d) and 6 depict in greater detail the iconic interfaces for the customer self service system that enable the use of a rich set of assumed, sensed, inferred, and derived contexts with minimal user effort.

With initial logon, as shown in FIG. 2, the system first presents a set of user contexts which are available to the user via the simplified iconic interface 12 of FIG. 2. The system will suggest one context over the others, but the user may select the one most appropriate to their current situation. In each session, the user selects only one user context to use, however over time each user may discover that a couple of different user contexts serve their needs in differing circumstances. On this screen 13 particularly, the user then enters a query via one or more methods including text via a web browser display interface, for example, or via voice, for example, with help of voice recognition software. It should be understood however, that query entry is not limited to these types of methods. The user will then initiate a lookup and proceed either to a third process step (via most direct path 52) for viewing a search result response set via the Results Display Workspace interface 32, or, proceed to a second step (via path 50) to optionally refine/override search variables via the Detail Specification Workspace interface 22.

FIG. 4 illustrates in detail the first graphical user interface 12 including the initial Context Selection Workspace 13 that

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enables the expression of user context as part of a query. As shown in FIG. 4, the Context Selection Workspace 13 includes: a series of one or more selectable User Context Icons 132 presented to the user for selecting user contexts; and, a Query Entry Field 131 enabling user entry of search terms via text or voice entry, for example. In accordance with the principles of the invention, the User Context Icons 132 are graphical user interface elements from which the user selects the one context most representative of his/her current situation. The icons presented in this interface each represent a packaging of sets of attribute-value pairs which describe a kind of user in a particular situation. Particularly, a user context represents a predefined set of context attributes which are relevant to the search behavior/needs of a group of users. For example, as described herein, context may include aspects of the user's knowledge, their relationship to organizations and/or communities, their user environment(s), and their resource need. All of these combine to provide a rich context surrounding the actual query which can significantly improve the outcome of the search through resources.

The Context Selection Workspace 13 thus enables the expression of user context as part of the query and is optimized for ease of use. Particularly, the user selects from one or more of the several displayed context icons 132 by clicking on them. A context "applier" pre-process described in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,378 is invoked at each session initiation for a user's search transaction, using a minimal or null user data set to produce defaults for user context, attributes, values, and resource parameters for the initial display of the Context Selection Workspace 13. This pre-processing step delivers additional benefits to the user by ensuring the use of the most current data and functions operating in the system. After making the initial query entry, by selecting hyperlink 134, the user is able to initiate the search and proceed directly to the third interface 32 which displays the actual search results. Alternately, by selecting hyperlink 135, the user may proceed to the second interface 22 having the Detail Specification Workspace 23 for further query editing and/or context refinement.

Returning to FIG. 2, with respect to the second step, the user is able to fine tune or override context attribute values, value resource parameters, and resource selection criteria and value ranges, using a drag and drop interface, iconic pull downs, and/or slide buttons. The user may return to this screen as many times as needed to find a suitable response set. Particularly, via the second iconic interface 22, the User Context selected in the first step has been made explicit by its default settings on all the iconic interface elements listed. Thus, via a Detail Specification Workspace 23 the user may: 1) modify the query (via text entry or voice, for example); 2) change the value of attributes associated with the user context (using pull down menus); alter the value resource parameters (e.g., include/exclude) using checkboxes; 3) customize the subset of responses by altering the resource selection criteria, including the weighting of criteria and the ordering of criteria on the final display, (e.g., using checkbox and/or numeric entry); and, 4) further refine the selection by specifying minimum/maximum acceptable value ranges for resource selection criteria through drag and drop of "tabs" on sliders, for example. After making the necessary adjustment, the user re-initiates the lookup and may proceed to the third step via path 51.

FIGS. 5(a)–5(d) illustrate in detail aspects of the second iconic graphical user interface 22 which enables the user to define or change all the parameters associated with their

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query 131 and (single) selected user context 132. As shown in FIGS. 5(a)–5(d), the graphical user interface 22 is divided into the following sections: a section for displaying the Query Entry field 131 as entered on the prior interface screen (FIG. 4) and available for editing; a section for displaying navigation arrows which allow the user to proceed with the search 134, or return to the initial Context Selection screen 136 via the first iconic interface to initiate a new query or select a different user context; and, a Detailed Specification Workspace 23 which is where all the search parameters can be explicitly viewed and modified. There are only two things the user cannot change from this screen: the user context selected (which they may change only on the Context Selection screen) and the context attributes which are linked to the user context (and which are predefined in the Context Attributes Master database 14).

As shown in FIGS. 5(b)–5(d), within the Detailed Specification Workspace 23 there comprises: an Attribute-Value Workspace 231, for enabling the user to change the attribute values for all the context attributes, represented as graphic elements 232, associated with the selected user context icon 132 (FIG. 4); and, a Resource Selection Criteria Workspace 238, for enabling the user to define the criteria 245 to be used in evaluating resources, define minimum and maximum acceptable values provided on slider elements 250 corresponding to each criteria, specify the weight assigned to those criteria via selection boxes 242, and specify the positioning of those criteria in a graphical display of the resources selected via selection boxes 241. As will be described, FIG. 3 provides sample data for the context attribute, attribute value, value resource parameters, and partial resource selection criteria from different domains which may be represented in the Detailed Specification Workspace 23.

As shown in FIG. 5(c), with more particularity, the Detailed Specification Workspace 23 additionally includes the Value—Resource Parameter Workspace 235, for enabling the user to change or create resource parameters using include logic 237 or exclude logic 239 for any attribute value 232 selected in the Attribute-Value Workspace 231. More specifically, the Attribute-Value Workspace 231 includes graphical representations of all the context attributes 232 associated with the single (currently active) selected user context 132. Each context attribute 232 is displayed with a text title 233 for the attribute. The currently active attribute value for that context attribute is shown on each context attribute icon. In addition, if the user has substituted, as described below, a context attribute value different than the default value provided for this user session, a marker 253 is displayed on the corner of the context attribute icon. If the user "mouse clicks" on the context attribute element, e.g., icon 232b, the system displays a pull down menu 234 of graphic elements showing all the possible attribute values for this context attribute. If the user "mouses over" any of the values from pull down menu 234, e.g., attribute value 236, a textual description 236' supporting the element may appear. By selecting a context attribute element from the pull down menu 234, e.g., element 236 shown highlighted in FIG. 5(c), the user is enabled to fine tune their selected context based upon their current situation. If the user "mouse clicks" on a value other than the current default, the new value is "selected" to substitute for the default. If the user "double clicks" on the attribute value, the system prepares the Value-Resource Parameter Workspace 235 for this single attribute value, as will be described. FIG. 3 provides sample data for context attributes and attribute values from different domains which may be represented in the Attribute Value Workspace 231.

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In the Value—Resource Parameter Workspace **235**, the user may change or create resource parameters using include logic or exclude logic for any context attribute value **232** selected in the workspace **231**. Regarding FIG. 5(c), with more particularity, the Value-Resource Parameter Workspace **235** is displayed for one attribute value at a time and is only displayed when requested via a double click, for example, on one of the attribute values displayed in the attribute Value Workspace **231**, e.g., attribute value **236**. The Value-Resource Parameter Workspace **235** is a pre-formatted two-column space (dialog box) where the user may establish inclusionary resource filters via checkboxes **237** and/or exclusionary resource filters via checkboxes **239**, based upon pre-established resource characteristics **236** for that selected attribute value. The value resource parameter data elements are pre-set by the user's know context, prior history of selecting from resources identified by the system, and potentially by corporate/organizational policy implemented through the system. By making these additional specifications, the user is enabled to increase the relevance of the resource response set based upon their current situation and personal preferences. When finished with these specifications, the user may double click to close this box **235** and return to the Attribute Value Workspace **231**. This step can be repeated for as many attribute values as the user would like to refine and may be executed either before or after the search is conducted. Value resource parameter data elements associated with context attributes for different domains, are provided in FIG. 3 as samples of data which may be represented in this Value- Resource Parameter Workspace **235**.

Regarding FIG. 5(d), with more particularity, the Resource Selection Criteria Workspace **238** includes a list of criteria **245** which may be used in evaluating resources. This list, provided by the system, is customized by domain; but in all domains, it involves criteria including, but not limited to issues such as: cost, time, timing, quality and risk associated with using a particular resource to satisfy the user's specific need. The initial system default might be to use all criteria and weight them equally. Over time, however, the default criteria may be set by the system based upon user context, user prior transaction history and user behavior on prior searches. If the user wishes to further reduce the set of criteria, they may do so by assigning a weight, for example a percentage weight, to each criteria they want used in the entry boxes **242**. Along with each of the criteria selected there exists a range of acceptable values specified on an associated individual slider element **250**. The initial system default, may be "unlimited" and then, may be set over time based upon user context, use and behavior. Additionally, the user may use drag and drop tabs **252a,b** on the slider element **250** to set a minimum and/or maximum value for the associated resource selection criteria. It is understood that the unit of measure on the sliders may vary by criteria. Further, via entry boxes **241**, the user may select to view via "check" or specify via number entry the display sequence of these criteria when arrayed as the axes on an n-dimensional graphic display provided in the Results Display Workspace via graphic interface **32** as described in commonly owned, co-pending U.S. Patent application Ser. No. 09/778,147, or when viewed on another visualization system.

The Detailed Specification Workspace **23** thus provides full disclosure of system defaults and enables the user to completely manage their search.

As mentioned, the ordered and annotated set of resources that the system has found to best match the user's initial query and related subject and context variables may be

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displayed through a number of interfaces including, but not limited to, the intuitive iconic interface **32** for visualizing and exploring the response set. The annotations **38** specifically are used to inform the iconic user interface **32** (FIG. 6) what resources to display in response to the query and how to display them.

FIG. 6 illustrates in detail the third iconic graphical user interface **32** described in greater detail in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,147. As shown in FIG. 6, the graphical user interface **32** is divided into the following sections: a section for displaying the Query Entry field **131** as entered on the prior interface screen (FIG. 4) and available for editing; a section for displaying a navigation arrow **135** for enabling the user to proceed back to the Detailed specification Workspace **23** of FIG. 5(a), and arrow **136** for returning to the initial Context Selection screen via the first iconic interface to initiate a new query or select a different user context; and, a Results Display Workspace **33** that enables the user to visualize and explore the response set that the system has found to best match the user's initial query and related subject and context variables and that enables the user to continue working to learn about the resources suggested (detail/preview), narrow their results (selection) or re-display them in a more meaningful view for decision making (graphically).

The Results Display Workspace **33** particularly includes a graphic element **333** which comprises a list of ranked resources **338** returned by the user's query. Via this graphic element, the user is provided with ability to select via checkboxes **348**, for example, one or more resources for viewing of additional details. The response set **338** is ranked by the aggregate value and weighting defined by resource selection criteria and value ranges as described herein.

As shown in FIG. 6, the Results Display Workspace **33** displays the weighting **332** for each of the available resource selection criteria **339a, . . . , 339e**. The choices of weighting and selection of resource selection criteria are made on the Detail Specification Workspace described generally herein with respect to FIG. 5(d). Preferably, the system generates for display in the Results Display Workspace **33** a multidimensional plot **335** comprising one or more axes, e.g., **331a, . . . , 331e**, with each axis corresponding to each previously specified results selection criterion such as cost **339e**, time **339a**, timing **339b**, quality **339d** and risk **339c**. The plot is initiated in response to user selection of graph icon **337**, and the user's selection of one or more resources **338** from the displayed list **333** of ranked resources. Each axis **331a, . . . , 331e** is displayed in the sequence specified by the user in the detail specification workspace **23** and includes one or more data points **349** corresponding to each resource **348** selected from the list **333**. Each data point represents the value of the particular resource selection criteria represented by the axis for that resource. As the user moves his/her mouse over a data point resource on one of the axes **331a, . . . , 331e**, for example, data point **330a** on axis **331a** in FIG. 6, the resource represented by that data point is visually connected, e.g., by line **334**, to all the other points for that same resource, e.g., points **330b–330e**. Additionally, in response to such showing, the values for all the resource selection criteria and name and rank of the resource **342** is displayed. It is understood that the locations of the data points **349** on each axis reside between the minimum and maximum resource selection criteria values indicated by the slider bars **252a, 252b** as previously set by the user in the detailed specification workspace **23** of FIG. 5(d).

The interface **32** is additionally provisioned with an icon **346** selectable for initiating the display of a Resource Detail



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Display portion 336 shown in FIG. 6, which is a graphical element used to provide further details or previews of the resources 338 selected from the list of ranked resources 333. Besides providing a text description 329 of the resource, including name, cost, timing, and terms and conditions, the graphical element 336 may be provided with hyperlinks 351–353 enabling the user to read more details regarding the resource, see pictures of the resource, or preview the resource, respectively. It should be understood that icon 337 for viewing the graph or the icon 346 for viewing detailed descriptions of the actual resources are independently selectable.

As further shown in FIG. 6, the user has the additional option 347 to view a detailed description of a currently plotted resource highlighted or shown in the graphic portion 335. The detailed description of a currently plotted resource is displayed via the Resource Detail Display portion 336.

Thus, with respect to the third step, a display of the annotated response set is provided in a form ready for preview or selection. The user may rework this screen as many times as needed to better understand and make decisions about resource(s) to use. More particularly, via the results display workspace interface 32 the user may: 1) view the response set, ranked by the aggregate value and weighting as defined by resource selection criteria and value ranges; 2) select one or many of the ranked responses for graphical display in multi-dimensions along the multiple axes of the resource selection criteria; and, 3) initiate a “roll over” of one or more resources from either the ranked list or the graphical display to view detailed descriptions or to “preview” the resource. If there are too many responses, too few, or if they are incorrect, the user may return to the second step to further refine/redefine, and re-execute the lookup. Alternately, the user may return to the first step to choose a different context for their search.

While the system is intended to operate on a fully enabled graphic workstation or personal computer, it is intended that search definition and the results visualization processes described herein with respect to FIGS. 4, 5(a)–5(d) and 6 may be operated by users of reduced graphics-enabled devices such as text screen workstations, Organizers, or any type of Personal Digital Assistants (PDAs). Accordingly, in alternative embodiments, all the context icons may have names, all the graphical displays may be reduced to lists, all the pull downs may be viewed as indented lists or secondary screens, and all the min-max sliders may convert to fill-in boxes. Further, as mentioned, the customer self service system described herein is applicable to many applications including the domains of education, real estate, and travel. The generic process flow described with respect to FIG. 2, will now be described with specific examples from the education, real estate and travel domains as shown in FIG. 3.

With respect to the education domain, the user is a learner and FIG. 3 depicts an example interaction with the system through the iconic interfaces (FIG. 2) included in the embodiment of the invention as applied to the education domain. The three iconic workspaces of FIG. 2 enable the learner to specify example data elements, such as the example data elements depicted in the Education (e.g., Environmental) column 60 of FIG. 3, and view results, as follows: In the first process step, the learner uses the Context Selection Workspace (interface 12 of FIG. 4) to specify their query 61 as “Learn Lotus Notes at home.” The learner may select the User Context “Remote Staffie”, for example (where the icon’s name is highlighted in FIG. 3), from among the available set of context icons 62. The learner may

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then elect to go to the Detail Specification Workspace (interface 22 of FIGS. 5(a)–5(d)) in the second process step in order to view the context attributes 63 associated with the “Remote Staffie” User Context. Preferably, the default assigned context attribute value (“DSL”, for example) for any context attribute (“Connectivity”, for example) is visible on the context attribute icon (“Connectivity”, for example, whose name is shown highlighted in FIG. 3). The learner may click on the context attribute “Connectivity” to see the menu of associated attribute values 64. The learner, for example, may select the “Disconnected” attribute value shown highlighted in FIG. 3. By double clicking on this attribute value, for example, the list of Value Resource Parameters, i.e., include/exclude filters 65, for the attribute value “Disconnected” is displayed. The learner, for example, may indicate that they want to include download and play resources and exclude online collaborative resources when searching for relevant resources. The learner may additionally specify resource priorities 66 by selecting, sequencing and weighting and specifying minimum and maximum values for relevant criteria such as cost, time, quality and risk on the Resource Selection Criteria Definition graphical user interface element on the Detail Specification Workspace (interface 22 of FIGS. 5(a)–5(d)). In the third step of the process, the results of the learner’s search are listed in the user view of the Results Display Workspace (interface 32 of FIG. 2). The learner may immediately select one or more of the listed education resources, request to see additional details on them, or request to see a response set graphic indicating the relative positioning of each resource along each of the axes (n-dimensions, relating to cost, time, quality and risk) specified earlier. If no acceptable education resources were provided, the learner may return to the Context Selection Workspace to redefine their query or select a different User Context such as “Commuting Techie” via the first interface. The learner may additionally elect to return to the Detail Specification Workspace of the second interface to change the default value of the context attribute “Connectivity” from Disconnected to Dial-up and add or remove Value Resource Parameters for the attribute value Dial-up or other context attribute values associated with context attributes such as “Learning Mode” or “Technical Field”. The learner may also change their selection criteria, the weighting of the selection criteria, and the minimum/maximum values for any selection criteria, in hopes of identifying additional relevant resources.

With respect to the education domain, the user is a “learner” however, the three iconic workspaces of FIG. 2 provide the process for enabling the learner to specify example data elements, such as the example data elements depicted in the Education (e.g., Subject Matter) column 70 of FIG. 3, and view results, as follows: In the first process step, the learner uses the Context Selection Workspace (interface 12 of FIG. 4) to specify their query 71 as “Become a Linux developer by June” for example. The learner selects the User Context “Commuting Techie” from among the available context icons 72. The learner may elect to go to the Detail Specification Workspace in order to view the context attributes 73 associated with the “Commuting Techie” user context. Preferably, the default assigned context attribute value (“Programming”, for example) for any context attribute (“Technical Field”, for example) is visible on the context attribute icon (“Technical Field”, for example, whose name is shown highlighted in FIG. 3). In addition, the learner may click on the context attribute (“Technical Field, to stay with the example) to display a pull down menu to view the other values 74 (in either picture or word format)

that could be assigned to this attribute. The learner, for example, may select “Graphical Interfaces” shown highlighted in FIG. 3. By double clicking on this attribute value, the list of Value Resource Parameters (include/exclude filters 75) for the attribute value “Graphical Interfaces” will be displayed. For example, the learner may indicate that they want to include the KDE interface and exclude the GNOME interface when searching for relevant resources. The learner may additionally specify resource priorities 76 by selecting, sequencing and weighting and specifying minimum and maximum values for relevant criteria such as cost, time, quality and risk on the Resource Selection Criteria Definition graphical user interface element on the Detail Specification Workspace. The results of the learner’s search are listed on the Results Display Workspace via the interface 32. The learner may immediately select one or more of the listed education resources, request to see additional details on them, or request to see a response set graphic indicating the relative positioning of each resource along each of the axes (n-dimensions, relating to cost, time, quality and risk) specified earlier. If no acceptable education resources were provided, the learner may return to the Context Selection Workspace 13 via the first interface 12 to redefine their query or select a different user context such as “Traveling Consultant.” The learner may also elect to return to the Detail Specification Workspace via the second interface 22 to change the default value of the context attribute “Technical Field” from Graphical Interfaces to Programming and add or remove Value Resource Parameters for the attribute value Programming or other context attribute values associated with context attributes such as “Learning Mode” or “Connectivity.” The learner may also change their selection criteria, the weighting of the selection criteria, and the minimum/maximum values for any selection criteria, in hopes of identifying additional relevant resources.

With respect to the real-estate domain, the user is a real estate transactor (renter/buyer) and FIG. 3 depicts an example interaction with the system through the iconic interfaces (FIG. 2) included in the embodiment of the invention as applied to the real estate domain. The three iconic workspaces of FIG. 2 enable a real estate renter or buyer to specify example data elements, such as the example data elements depicted in the Real Estate column 80 of FIG. 3, and view results, as follows: In the first process step, the renter or buyer uses the Context Selection Workspace to specify their query 81 as “Find housing near new job by August.” The renter or buyer selects the user context “Relocating Business Professional” from among the available context icons 82. The renter or buyer may elect to go to the Detail Specification Workspace in the second interface in order to view the context attributes 83 associated with the “Relocating Business Professional” user context. Preferably, the default assigned context attribute value (“Subcontract it all”, for example) for any context attribute (“Maintenance Style”, for example) is visible on the context attribute icon (“Maintenance Style”, for example, whose name is shown highlighted in FIG. 3). In addition, the renter/buyer may click on the context attribute (“maintenance style”, to stay with the example) to display a pull down menu to view the other values 84 (in either picture or word format) that could be assigned to this attribute. Upon renter or buyer double clicking on attribute value “Do-It-YourSelf-er”, for example, the list of Value Resource Parameters (include/exclude filters 85) for the attribute value “Do-It-YourSelf-er” is displayed. For example, as shown in FIG. 3, the renter or buyer may indicate that they want to include walls, paint and lawn mowing and exclude plumbing, electrical and

landscaping when searching for relevant resources. The renter or buyer may additionally specify resource priorities 86 by selecting, sequencing and weighting and specifying minimum and maximum values for relevant criteria such as cost, time, quality and risk on the Resource Selection Criteria Definition graphical user interface element on the Detail Specification Workspace. The results of the renter or buyer’s search are listed on the Results Display Workspace of the third interface 32 in which the renter or buyer may immediately select one or more of the listed real estate resources, request to see additional details on them, or request to see a response set graphic indicating the relative positioning of each resource along each of the axes (n-dimensions, relating to cost, time, quality and risk) specified earlier. If no acceptable housing resources were provided, the renter or buyer may return to the Context Selection Workspace to redefine their query or select a different user context such as “Empty Nester.” The renter or buyer can also elect to return to the Detail Specification Workspace to change the default value of the context attribute “Maintenance Style” from Do-It-YourSelf-er to Subcontract It All, for example, and add or remove Value Resource Parameters for the attribute value “Subcontract It All” or other context attribute values associated with context attributes such as “Mode of Commute to Work/School” or “Mode of Housing.” The real estate transactor may also change their selection criteria, the weighting of the selection criteria, and the minimum/maximum values for any selection criteria, in hopes of identifying additional relevant resources.

With respect to the travel domain, the user is a traveler and FIG. 3 depicts an example interaction with the customer self service system through the iconic interfaces (FIG. 2) included in the embodiment of the invention as applied to the travel domain. The three iconic workspaces of FIG. 2 enable a traveler to specify data elements, such as the example data elements depicted in the Travel column 90 of FIG. 3, and view results, as follows: In the first process step, the traveler uses the Context Selection Workspace to specify their query 91 such as “Plan a trip to Vermont in June”, for example. The traveler may then select the User Context Icon “Single Mom with kids”, for example, from among the available user context icons 132, (where the icon’s name 92 is highlighted in FIG. 3). The traveler may then elect to go to the Detail Specification Workspace in order to view the context attributes 93 associated with the “Single Mom with Kids” user context. Preferably, the default assigned context attribute value (“Drive”, for example) for any context attribute (“Mode of Transportation”, for example) is visible on the context attribute icon (“Mode of Transportation”, for example, whose name is shown highlighted in FIG. 3). In addition, the traveler may click on the context attribute (“mode of transportation”, to stay with the example) to display a pull down menu to view the other values 94 (in either picture or word format) that could be assigned to this attribute (“Fly” for example). The traveler selects “fly” as an alternative to “drive”, as illustrated with highlighting in FIG. 3. By “overriding” this attribute value and double clicking on it, the list of Value Resource parameters (include/exclude filters 95) for the attribute value “Fly” is displayed. The traveler may indicate that he/she wants to include all major carriers and exclude prop planes and airlines with bad safety records when searching for relevant resources. The traveler may also specify resource priorities 96 by selecting, sequencing and weighting and specifying minimum and maximum values for relevant criteria such as cost, time, quality and risk on the Resource Selection Criteria Defini-

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tion graphical user interface element on the Detail Specification Workspace. The results of the traveler's search are then displayed via the Results Display Workspace of the third iconic interface 32 of FIG. 2. The traveler may immediately select one or more of the listed travel resources, request to see additional details on them, or request to see a response set graphic indicating the relative positioning of each resource along each of the axes (n-dimensions, relating to cost, time, quality and risk) specified earlier. If no acceptable travel resources were provided, the traveler may return to the Context Selection Workspace in Step 1 to redefine their query or select a different user context such as "Swinging Singles." The traveler may also elect to return to the Detail Specification Workspace in Step 2 to change the default value of the context attribute "Mode of Transportation" from Fly to Train and add or remove Value Resource Parameters for the attribute value Train or other context attribute values associated with context attributes such as "Mode of Housing" or "Food Style". The traveler may also change their selection criteria, the weighting of the selection criteria, and the minimum/maximum values for any selection criteria, in hopes of identifying additional relevant resources.

Referring back to FIG. 1, the customer self service system implements an n-dimensional context vector 25', derived from the combination of user context and previous interaction with the system, to map specific contexts to specific resources. This increases the relevance of search results for a given user in their current context without requiring the user to explicitly train the system. Inferences and conclusions are made regarding both the individual user's preferred resource characteristics and those of a common set of users. These are used as input to the sub-processes described above and in greater detail in above-mentioned commonly-owned, co-pending U.S. patent application Ser. Nos. 09/778,378, 09/778,135, and 09/778,139, to modify the iconic interfaces presented to each particular user for their subsequent search using the current invention as well as to modify the results that would be selected for presentation to the user via the interface described in Ser. No. 09/778,147 in response to an identical search. Over time, the system will improve in its ability to serve individual needs and evolve to an ability to suggest preferred answers to groups of users.

The overall system also uses a batch background process described in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,149 to cluster user interaction records to assist in the identification of new user contexts which serves to improve the system over time.

While the prior art has made use of adaptive learning in information retrieval systems, the overall customer self service system for resource search and selection enables the use of a large, rich set of contextual attribute-value pairs, is focused on learning about the user/user groups rather than the resources/resource groups and is able to discover user group characteristics and apply them to individuals. Much of the prior art is focused on the discovery of database structure, the clustering of data within the resources, or discovering relevant taxonomy for resources but the current system discovers contexts and context attributes among users which can be used predictively. The customer self-service system of the invention uses a highly specialized and optimized combination of supervised and unsupervised logic along with both automated and semi-automated entry of learned results and is able to deliver higher value because contexts are used in a closed loop self improvement system; front end (entry) middle (search and display) and back end (results and user feedback) are integrated. Other systems

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apply machine learning at the front, middle, or back, but not integrated throughout. The current system identifies context classifications and functions, and applies them to individual users to reduce the burden of fully communicating their question and increasing the specificity and accuracy of a query's search parameters. The current system identifies and improves selection logic and identifies and improves response sets to common queries based upon a rich set of contextual variables. The current system additionally orders the response set, potentially further limiting it, and prepares the response set for display in a way that identifies the "best" resources for a particular user based upon the rich set of context variables. The display of the invention additionally illustrates the decision making characteristics of the alternatives presented.

While the invention has been particularly shown and described with respect to illustrative and preformed embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention which should be limited only by the scope of the appended claims.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent is:

1. A graphical user interface for a customer self service system that performs resource search and selection comprising:

a first visual workspace comprising entry field enabling entry of a query for a resource and, one or more selectable graphical user context elements, each element representing a context associated with the current user state and having context attributes and attribute values associated therewith;

a second visual workspace for visualizing the set of resources that the customer self service system has determined to match the user's query, said system indicating a degree of fit of said determined resources with said query;

a third visual workspace for enabling said user to select and modify context attribute values to enable increased specificity and accuracy of a query's search parameters, said third visual workspace further enabling said user to specify resource selection parameters and relevant resource evaluation criteria utilized by a search mechanism in said system, said degree of fit indication based on said user's context, and said associated resource selection parameters and relevant resource evaluation criteria; and, a

mechanism enabling said user to navigate among said first, second and third visual workspaces to thereby identify and improve selection logic and response sets fitted to said query.

2. The graphical user as claimed in claim 1, wherein said relevant resource evaluation criteria includes one or more of: cost, risk, timing and quality.

3. The graphical user interface as claimed in claim 1, wherein said entry is made via one or more methods including text or voice.

4. The graphical user interface as claimed in claim 3, wherein said third visual workspace further enables users to select, sequence and weight said relevant evaluation criteria.

5. The graphical user interface as claimed in claim 1, wherein said detail specification workspace includes graphical means for specifying minimum and maximum values for each said relevant criteria.

6. The graphical user interface as claimed in claim 1, wherein said third visual workspace includes graphic



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resource filter elements for enabling user specification of inclusionary and exclusionary resource selection parameters associated with a selected context attribute value.

7. The graphical user interface as claimed in claim 6, wherein said system enables display of the resources in accordance with said selection parameters, weight and sequencing criteria via said second visual workspace.

8. An interactive method for querying a customer self service system that performs resource search and selection, said method comprising the steps of:

- a) enabling via a graphic interface, entry of a query and selection of one or more user context icons, each representing a context associated with the current user situation and having context attribute parameters associated therewith;
- b) enabling, via a first visual workspace provided in said graphic interface, user specification of relevant resource selection criteria for enabling expression of relevance of resource results in terms of user context and, user specification of relevant resource evaluation criteria;
- c) generating a resource response set for best matching a users query based upon user input context attributes and user defined relevant resource selection criteria, and enabling user visualization of said response set via a second visual workspace provided in said graphic interface, said step further indicating a degree of fit of said determined resources with said query based on said user's context, and said associated resource selection parameters and relevant resource evaluation criteria; and,
- d) navigating between said first and second visual workspaces to thereby identify and improve selection logic and response sets fitted to said query.

9. The interactive method as claimed in claim 8, wherein said step b) includes the step of selecting and modifying said context attribute values to enable increased specificity and accuracy of a query's search parameters.

10. The interactive method as claimed in claim 8, wherein said step b) further includes the step of enabling a user to select, sequence and weight said relevant evaluation criteria via said first visual workspace.

11. The interactive method as claimed in claim 8, wherein said step b) further includes the step of specifying minimum and maximum values for each said relevant criteria via said first visual workspace.

12. The interactive method as claimed in claim 8, wherein said step b) further includes the step of enabling user specification of inclusionary and exclusionary resource selection parameters associated with a selected context attribute provided in said first visual workspace.

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13. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform interactive method steps for querying a customer self service system that performs resource search and selection, said interactive method comprising the steps of:

- a) enabling via a graphic interface, entry of a query and selection of one or more user context icons, each representing a context associated with the current user situation and having context attribute parameters associated therewith;
- b) enabling, via a first visual workspace provided in said graphic interface, user specification of relevant resource selection criteria for enabling expression of relevance of resource results in terms of user context and user specification of relevant resource evaluation criteria;
- c) generating a resource response set for best matching a user's query based upon user input context attribute values and user defined relevant resource selection criteria, and enabling user visualization of said response set via a second visual workspace in said graphic interface; said step further including the step of indicating a degree of fit of said determined resources with said query based on said user's context, and said associated resource selection parameters and relevant resource evaluation criteria; and
- d) navigating between said first and second workspaces visual workspaces to thereby identify and improve selection logic and response sets fitted to said query.

14. The program storage device readable by machine as claimed in claim 13, wherein said step b) includes the step of selecting and modifying said context attribute values to enable increased specificity and accuracy of a query's search parameters.

15. The program storage device readable by machine as claimed in claim 13, wherein said step b) further includes the step of enabling a user to select, sequence and weight said relevant evaluation criteria via said first visual workspace.

16. The program storage device readable by machine as claimed in claim 13, wherein said step b) further includes the step of specifying minimum and maximum values for each said relevant criteria via said first visual workspace.

17. The program storage device readable by machine as claimed in claim 13, wherein said step b) further includes the step of enabling user specification of inclusionary and exclusionary resource selection parameters associated with a selected context attribute value provided in said first visual workspace.

\* \* \* \* \*



# **EXHIBIT 3**



**DESMARAIS** LLP

# **Zillow Infringes U.S. Patent No. 6,778,193 (Biebesheimer)**

*Subject to Fed. R. Evid. 408*

# U.S. Patent No. 6,778,193 (Biebesheimer) – Overview

(12) <b>United States Patent</b> <b>Biebesheimer et al.</b>	(10) <b>Patent No.:</b> <b>US 6,778,193 B2</b> (45) <b>Date of Patent:</b> <b>Aug. 17, 2004</b>
(54) <b>CUSTOMER SELF SERVICE ICONIC INTERFACE FOR PORTAL ENTRY AND SEARCH SPECIFICATION</b>	(List continued on next page.) <b>OTHER PUBLICATIONS</b>
(75) Inventors: <b>Debra L. Biebesheimer</b> , Carmel, NY (US); <b>Donn P. Jasura</b> , Staatsburg, NY (US); <b>Neal M. Keller</b> , Somers, NY (US); <b>Daniel A. Oblinger</b> , New York, NY (US); <b>Mark E. Podlaseck</b> , New Preston, CT (US); <b>Stephen J. Rolando</b> , Katonah, NY (US)	Mladenec, D, "Text-learning and related intelligent agents: a survey", IEEE Intelligent Systems, IEEE, vol. 14, No. 4, Jul. 1999, pp. 44–54, XP-002205012. Göker, A., "Capturing Information Need by Learning User Context", 16th International Joint Conferent in Artificial Intelligence: Learning About User Workshop, Jul. 31, 1999, pp. 21–27, XP-002205013.
(73) Assignee: <b>International Business Machines Corporation</b> , Armonk, NY (US)	(List continued on next page.)
( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 625 days.	<i>Primary Examiner</i> —Steven Sax (74) <i>Attorney, Agent, or Firm</i> —Scully, Scott, Murphy & Presser; Daniel P. Morris, Esq.
(21) Appl. No.: <b>09/778,136</b>	(57) <b>ABSTRACT</b>
(22) Filed: <b>Feb. 7, 2001</b>	A graphical user interface for a customer self service system that performs resource search and selection. The interface comprises an entry field enabling entry of a query for a resource and selection of one or more user context icons, each representing a context associated with the current user situation, and having context attributes associated therewith; a first visual workspace is provided for visualizing and exploring the set of resources that the customer self service
(65) <b>Prior Publication Data</b>  US 2002/0149614 A1 Oct. 17, 2002	

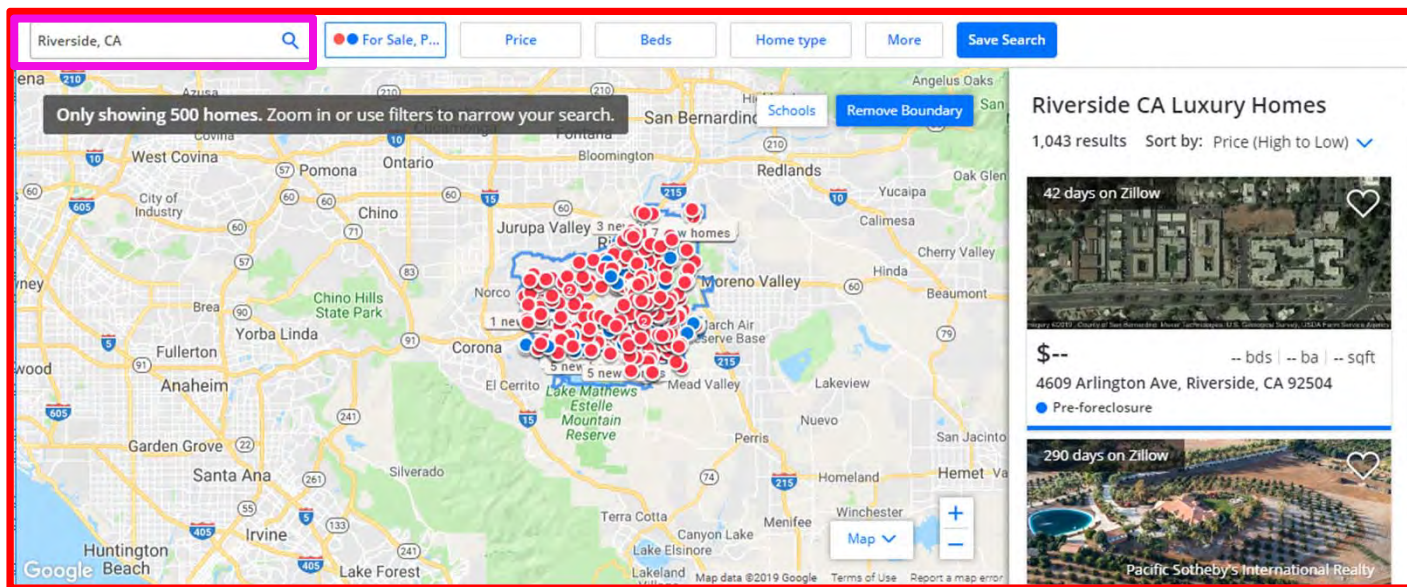
# U.S. Patent No. 6,778,193 (Biebesheimer) – Claim 1

**1. A graphical user interface for a customer self service system that performs resource search and selection comprising:**

- **(a) a first visual workspace comprising entry field enabling entry of a query for a resource and, one or more selectable graphical user context elements, each element representing a context associated with the current user state and having context attributes and attribute values associated therewith;**
- **(b) a second visual workspace for visualizing the set of resources that the customer self service system has determined to match the user's query, said system indicating a degree of fit of said determined resources with said query;**
- **(c) a third visual workspace for enabling said user to select and modify context attribute values to enable increased specificity and accuracy of a query's search parameters, said third visual workspace further enabling said user to specify resource selection parameters and relevant resource evaluation criteria utilized by a search mechanism in said system, said degree of fit indication based on said user's context, and said associated resource selection parameters and relevant resource evaluation criteria; and, a**
- **(d) mechanism enabling said user to navigate among said first, second and third visual workspaces to thereby identify and improve selection logic and response sets fitted to said query.**

# U.S. Patent No. 6,778,193 (Biebesheimer) – Claim 1

## 1. A graphical user interface for a customer self service system that performs resource search and selection comprising:



<https://www.zillow.com>

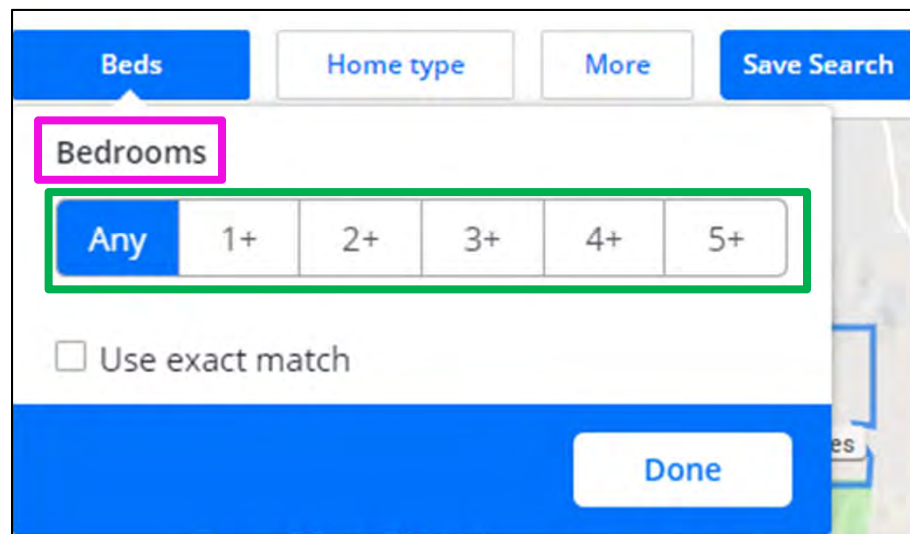
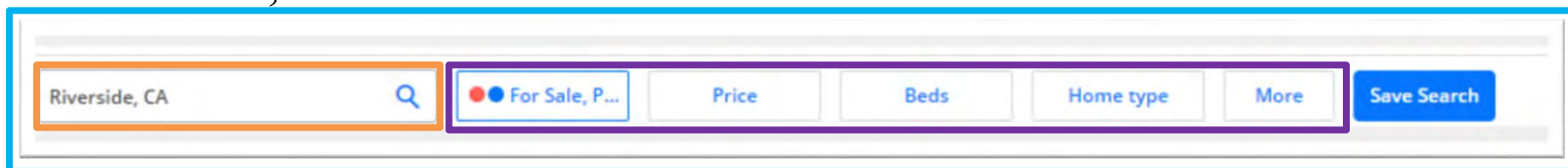
### Zillow

Zillow is the leading real estate and rental marketplace dedicated to empowering consumers with data, inspiration and knowledge around the place they call home, and connecting them with the best local professionals who can help.

<https://www.zillow.com/corp/About.htm>

# U.S. Patent No. 6,778,193 (Biebesheimer) – Claim 1

(a) a first visual workspace comprising entry field enabling entry of a query for a resource and, one or more selectable graphical user context elements, each element representing a context associated with the current user state and having context attributes and attribute values associated therewith;



**Query:** “[A]n entry field for entering search data by using text or voice methods, for example, but not limited to these methods.” (Biebesheimer at 9:13-15).

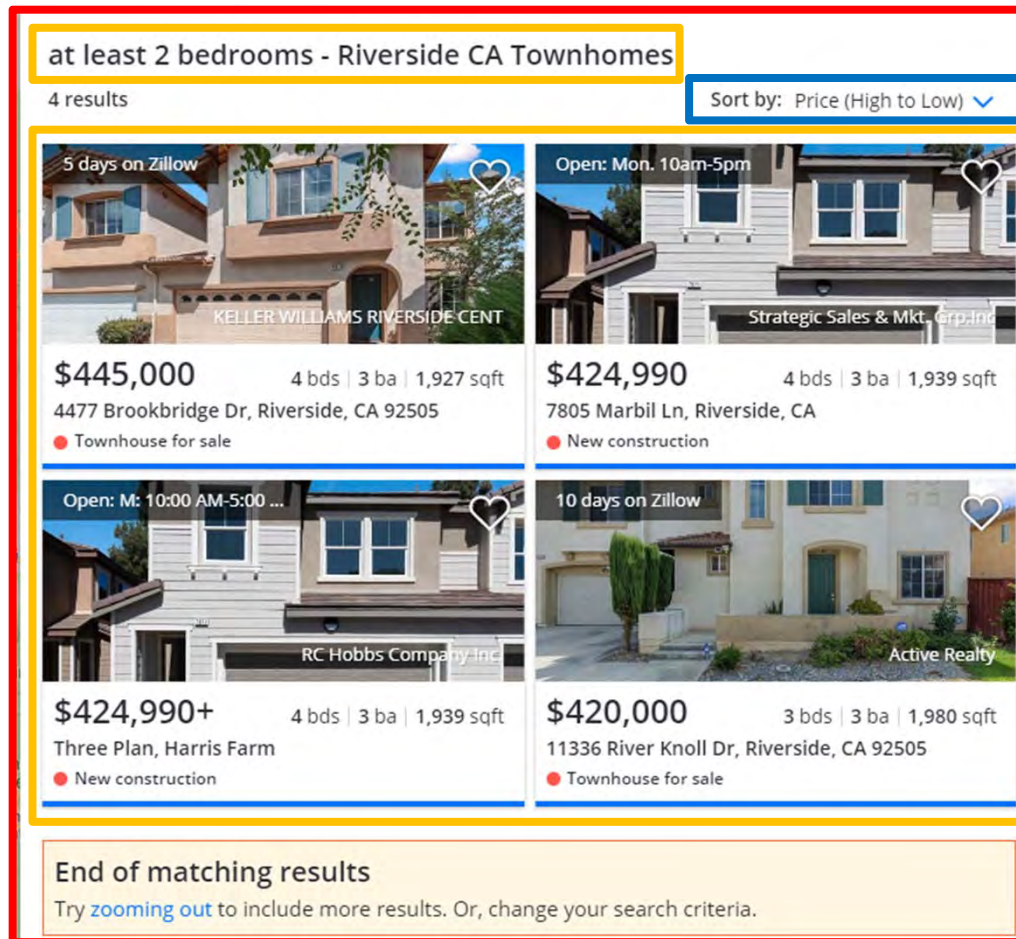
**User Context:** “[A] context associated with the current user situation, and having context attributes associated therewith.” (Biebesheimer at 4:20-23; 9:16-18).

**Context Attribute:** “An attribute is used to describe a characteristic associated with the User Context.” (Biebesheimer at 9:38-39).



# U.S. Patent No. 6,778,193 (Biebesheimer) – Claim 1

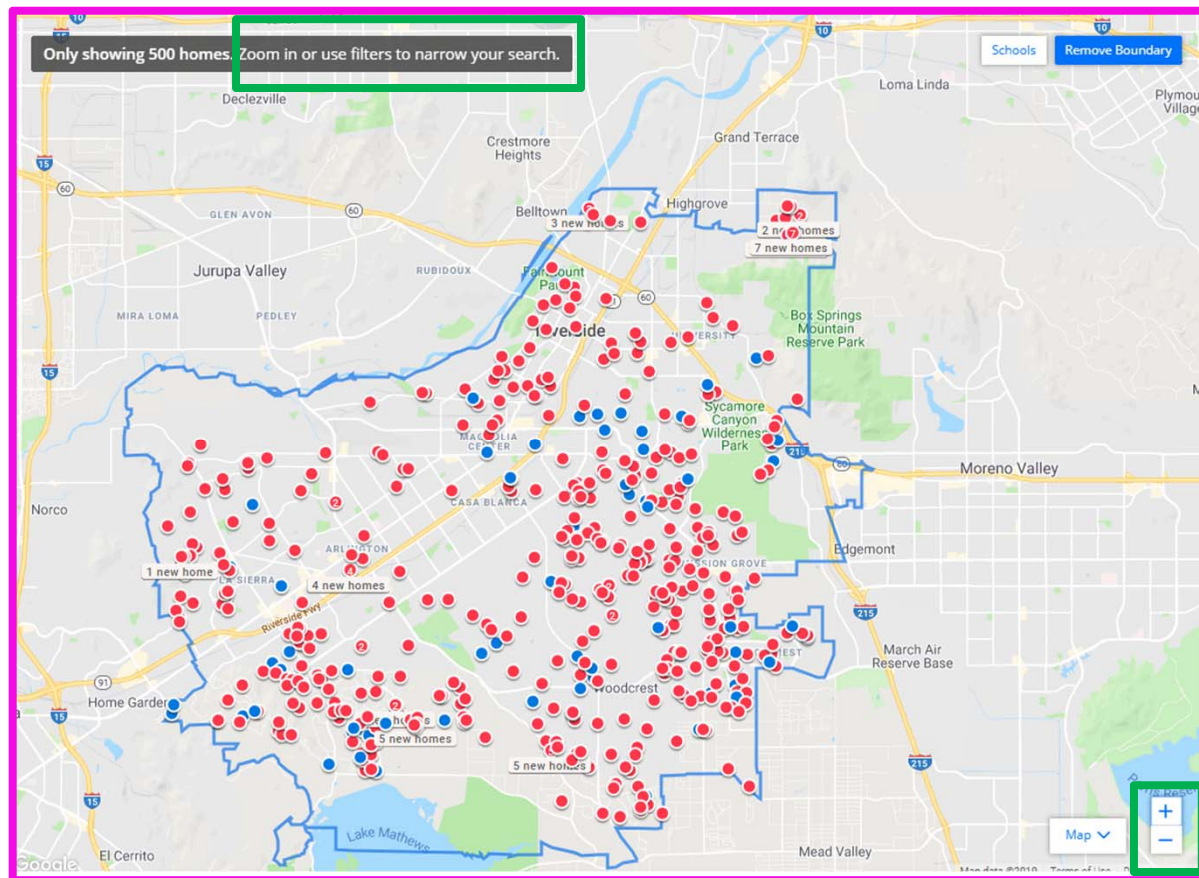
(b) a **second visual workspace for visualizing the set of resources that the customer self service system has determined to match the user's query,** said system indicating a degree of fit of said determined resources with said query;





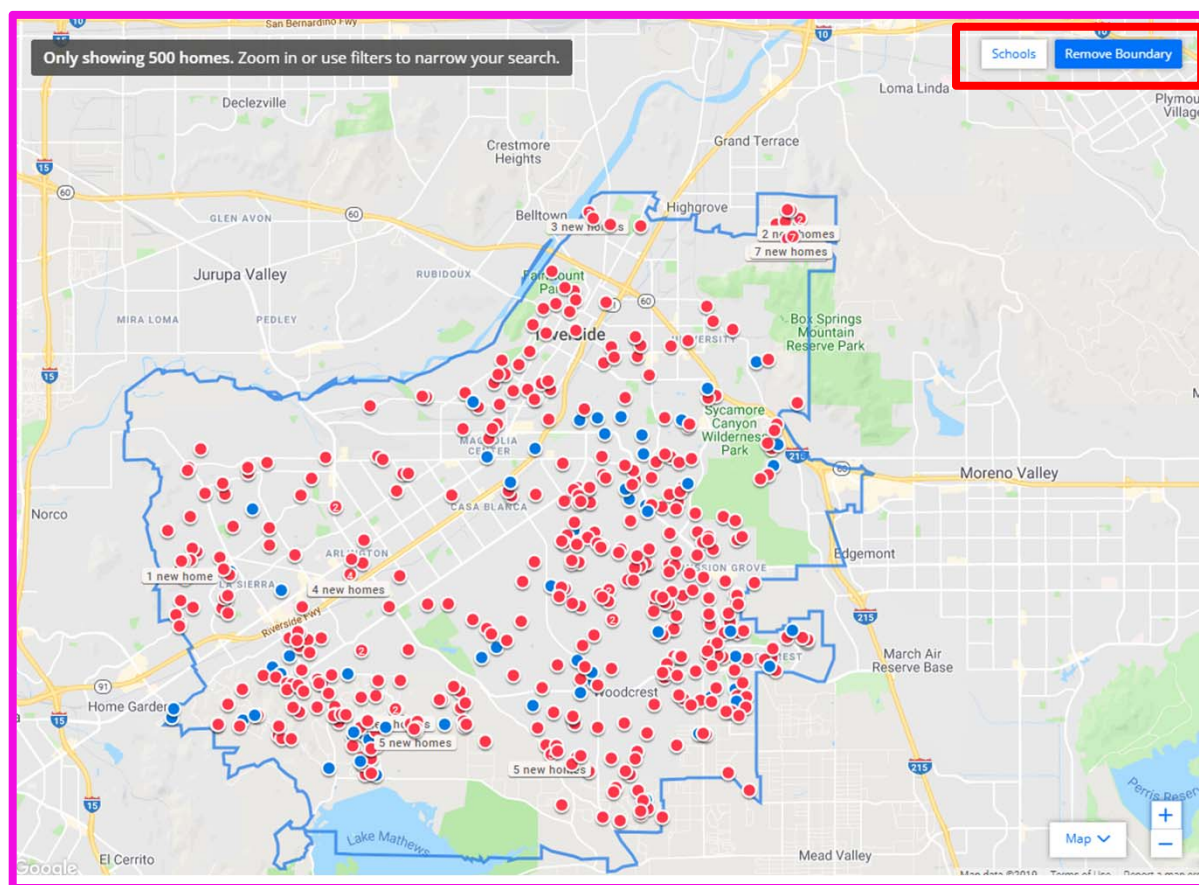
# U.S. Patent No. 6,778,193 (Biebesheimer) – Claim 1

(c) a **third visual workspace** for enabling said user to select and modify context attribute values to enable increased specificity and accuracy of a query's search parameters,



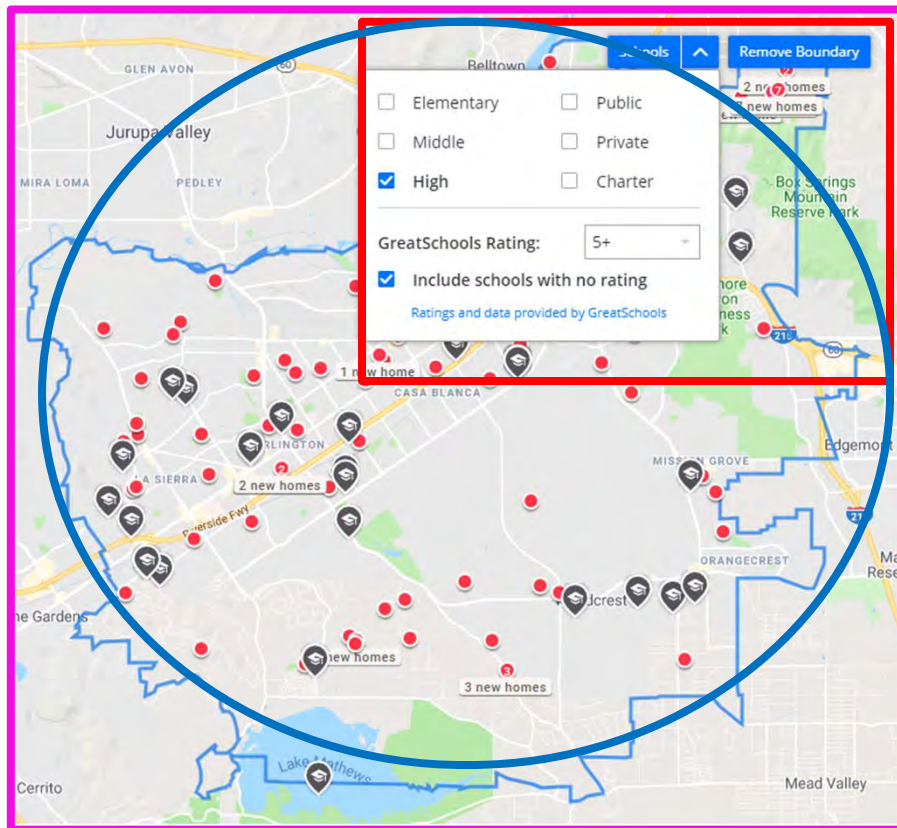
# U.S. Patent No. 6,778,193 (Biebesheimer) – Claim 1

said **third visual workspace** further enabling said user to specify resource selection parameters and relevant resource evaluation criteria utilized by a search mechanism in said **system**, said degree of fit indication based on said user's context, and said associated resource selection parameters and relevant resource evaluation criteria; and, a



# U.S. Patent No. 6,778,193 (Biebesheimer) – Claim 1

said third visual workspace further enabling said user to specify resource selection parameters and relevant resource evaluation criteria utilized by a search mechanism in said system, said degree of fit indication based on said user's context, and said associated resource selection parameters and relevant resource evaluation criteria; and



Returning to FIG. 2, with respect to the second step, the user is able to fine tune or override context attribute values, value resource parameters, and resource selection criteria and value ranges, using a drag and drop interface, iconic pull-downs, and/or slide buttons. The user may return to this screen as many times as needed to find a suitable response set. Particularly, via the second iconic interface 22, the User Context selected in the first step has been made explicit by its default settings on all the iconic interface elements listed.

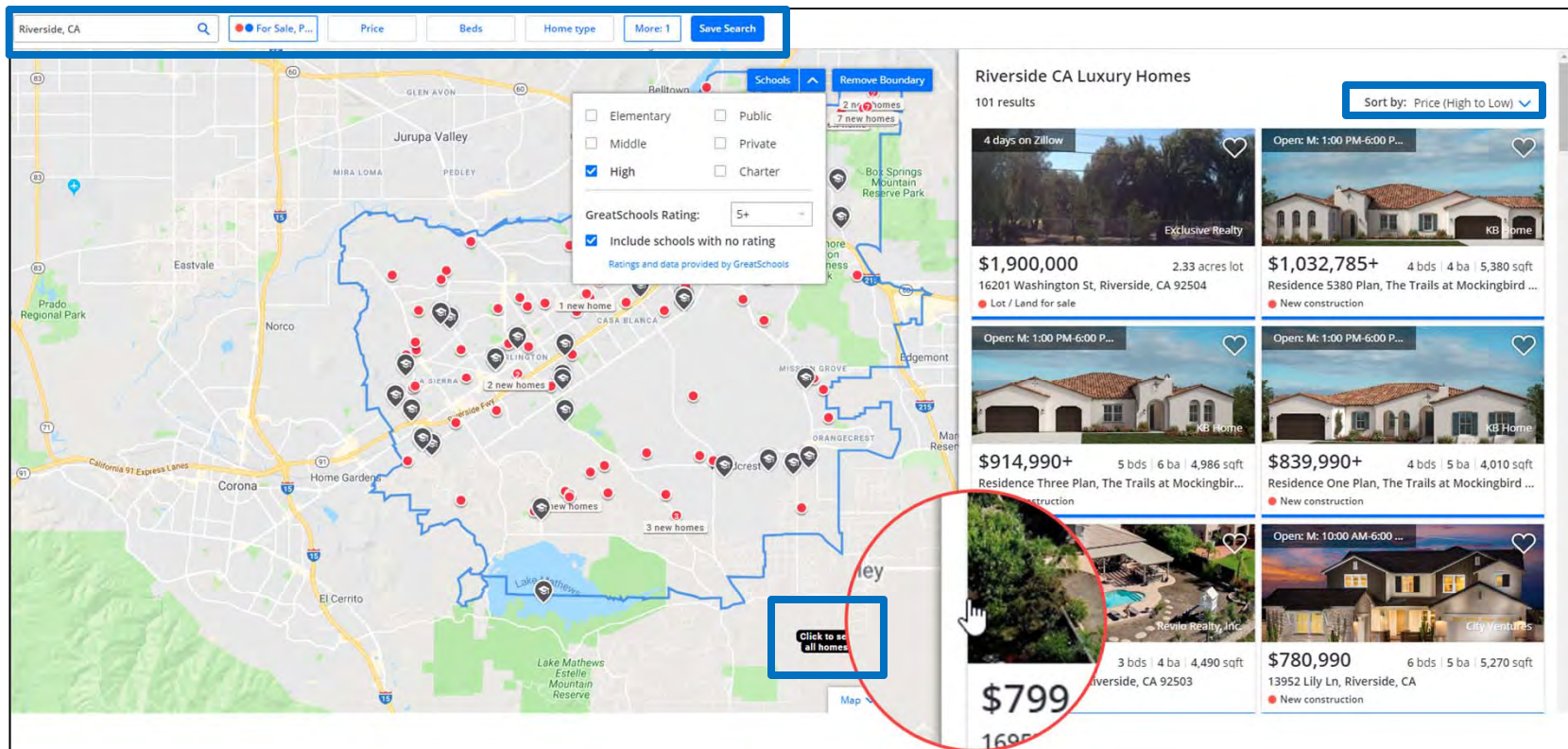
Thus, via a Detail Specification Workspace 23 the user may: 1) modify the query (via text entry or voice, for example); 2) change the value of attributes associated with the user context (using pull down menus); alter the value resource parameters (e.g., include/exclude) using checkboxes; 3) customize the subset of responses by altering the resource selection criteria, including the weighting of criteria and the ordering of criteria on the final display, (e.g., using checkbox and/or numeric entry); and, 4) further refine the selection by specifying minimum/maximum acceptable value ranges for resource selection criteria through drag and drop of "tabs" on sliders, for example. After making the necessary adjustment, the user re-initiates the lookup and may proceed to the third step via path 51.

(Biebesheimer at 11:42-64.)



# U.S. Patent No. 6,778,193 (Biebesheimer) – Claim 1

**(d) mechanism enabling said user to navigate among said first, second and third visual workspaces to thereby identify and improve selection logic and response sets fitted to said query.**



# **EXHIBIT 4**

(12) **United States Patent**  
**Oblinger**

(10) **Patent No.:** **US 6,785,676 B2**  
(45) **Date of Patent:** **Aug. 31, 2004**

(54) **CUSTOMER SELF SERVICE SUBSYSTEM  
FOR RESPONSE SET ORDERING AND  
ANNOTATION**

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(US)

(73) Assignee: **International Business Machines  
Corporation**, Armonk, NY (US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 310 days.

(21) Appl. No.: **09/778,139**

(22) Filed: **Feb. 7, 2001**

(65) **Prior Publication Data**

US 2002/0105532 A1 Aug. 8, 2002

(51) **Int. Cl.<sup>7</sup>** ..... **G06F 17/30; G06F 17/00**

(52) **U.S. Cl.** ..... **707/5; 707/4; 715/512**

(58) **Field of Search** ..... 707/1-8, 101-102,  
707/104.1; 345/700-702, 748, 744, 707-708;  
715/512

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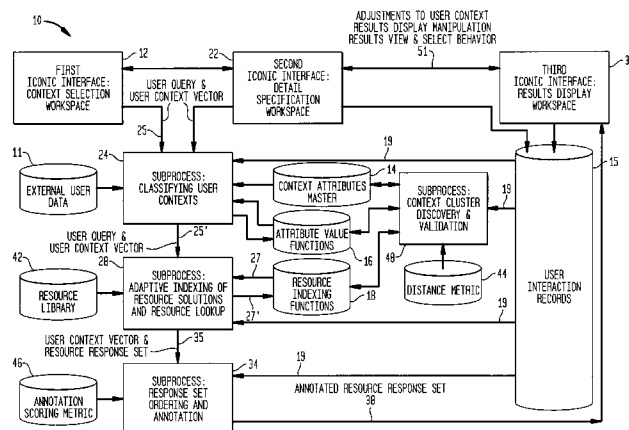
*Primary Examiner*—Alford Kindred

(74) *Attorney, Agent, or Firm*—Scully, Scott, Murphy &  
Presser; Daniel P. Morris, Esq.

(57) **ABSTRACT**

A system and method for annotating resource results obtained in a customer self service system that performs resource search and selection. The method comprising the steps of: receiving a resource response set of results obtained in response to a current user query and receiving a user context vector associated with the current user query, the user context vector comprising data associating an interaction state with the user; applying an ordering and annotation function for mapping the user context vector with the resource response set to generate an annotated response set having one or more annotations; and, controlling the presentation of the resource response set to the user according to the annotations, wherein the ordering and annotation function is executed interactively at the time of each user query. In an off-line process, a supervised learning algorithm is implemented for receiving user interaction data from among a database of user interaction records and an annotation scoring metric representing a measure of performance in locating resource response results displayed via a graphical interface. The algorithm generates ordering and annotation functions which are adaptable based on history of user interactions as provided in the database of user interaction records. The result of this invention is the ability to drive visualization systems for presenting resource response results in the most beneficial and meaningful way to the user via an interface when performing search and resource selection. The system and method is especially applicable for a self service system in a variety of customer self service domains including education, real estate and travel.

**28 Claims, 7 Drawing Sheets**





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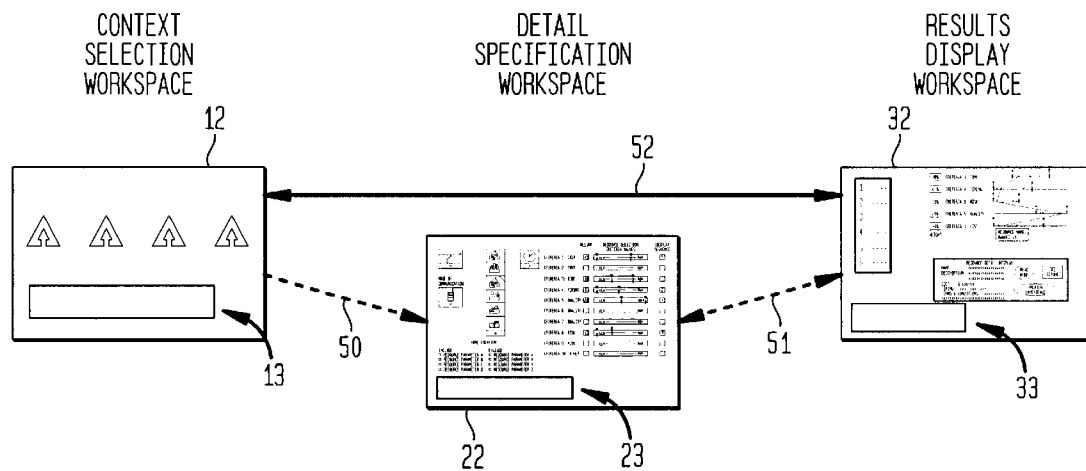
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FIG. 2



U.S. Patent

Aug. 31, 2004

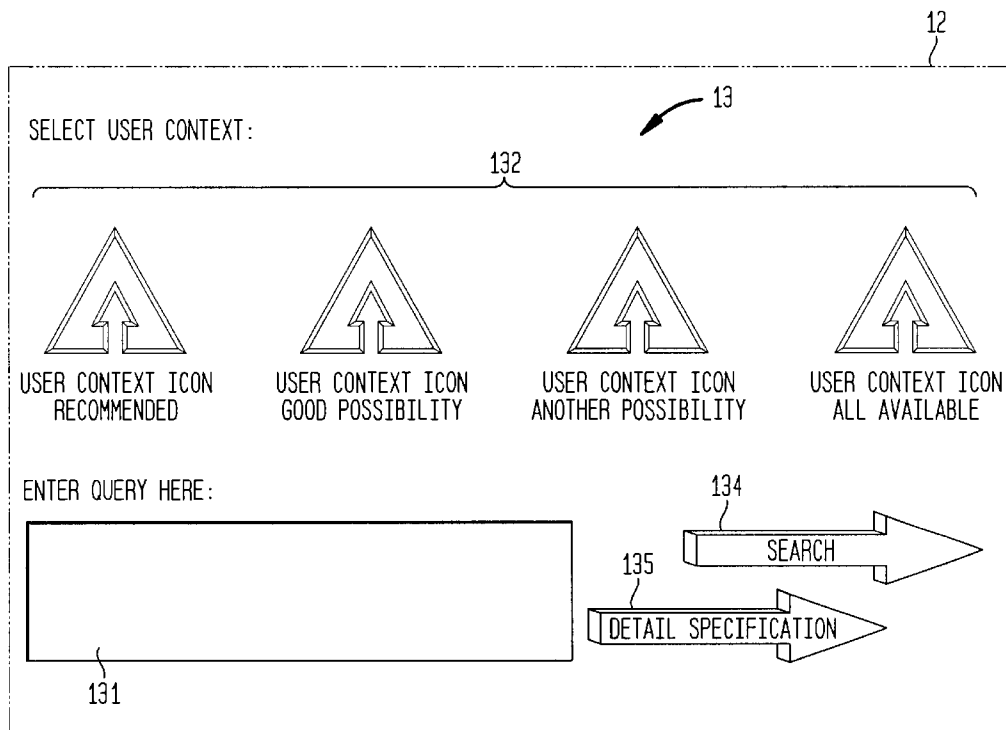
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FIG. 3

	EDUCATION (EX: ENVIRONMENT)	EDUCATION (EX: SUBJECT MATTER)	REAL ESTATE	TRAVEL
	60	70	80	90
USER QUERY	LEARN LOTUS NOTES AT HOME 61	BECOME A LINUX DEVELOPER BY JUNE 71	FIND HOUSING NEAR NEW JOB BY AUGUST 81	PLAN A TRIP TO VERMONT IN JUNE 91
USER CONTEXT	CORP EXEC AT HQ REMOTE STAFFIE COMMUTING TECHIE TRAVELING CONSULTANT 62	CORP EXEC AT HQ REMOTE STAFFIE COMMUTING TECHIE TRAVELING CONSULTANT 72	RELOCATING BUSINESS PROFESSIONAL EMPTY NESTER COLLEGE STUDENT 82	SINGLE MOM W/KIDS SWINGING SINGLES BUSINESS TRAVELER 92
CONTEXT ATTRIBUTE	CONNECTIVITY LEARNING MODE(S) TECHNICAL FIELD 63	CONNECTIVITY LEARNING MODE(S) TECHNICAL FIELD 73	MODE OF COMMUTE TO WORK/SCHOOL MODE OF HOUSING MAINTENANCE STYLE 83	MODE OF TRANSPORTATION MODE OF HOUSING FOOD STYLE 93
ATTRIBUTE VALUE	LAN CONNECTED DIAL UP DSL DISCONNECTED 64	SECURITY GRAPHICAL INTERFACES PROGRAMMING SYSTEMS INTEGRATION 74	CAREFREE LIVING SUBCONTRACT IT ALL DO-IT-YOURSELF-ER 84	DRIVE FLY TRAIN 94
VALUE RESOURCE PARAMETERS	INCLUDE: DOWNLOAD & PLAY RESOURCES ----- EXCLUDE: ON LINE COLLABORATIVE RESOURCES 65	INCLUDE KDE ----- EXCLUDE GNOME 75	INCLUDE WALLS INCLUDE PAINT INCLUDE LAWN MOWING ----- EXCLUDE PLUMBING EXCLUDE ELECTRICAL EXCLUDE LANDSCAPING 85	INCLUDE ALL MAJOR CARRIERS ----- EXCLUDE PROP PLANES EXCLUDE BAD SAFETY RECORDS 95
RESOURCE SELECTION CRITERIA & VALUES	COST TIME QUALITY RISK 66	COST TIME QUALITY RISK 76	COST TIME QUALITY RISK 86	COST TIME QUALITY RISK 96

FIG. 4



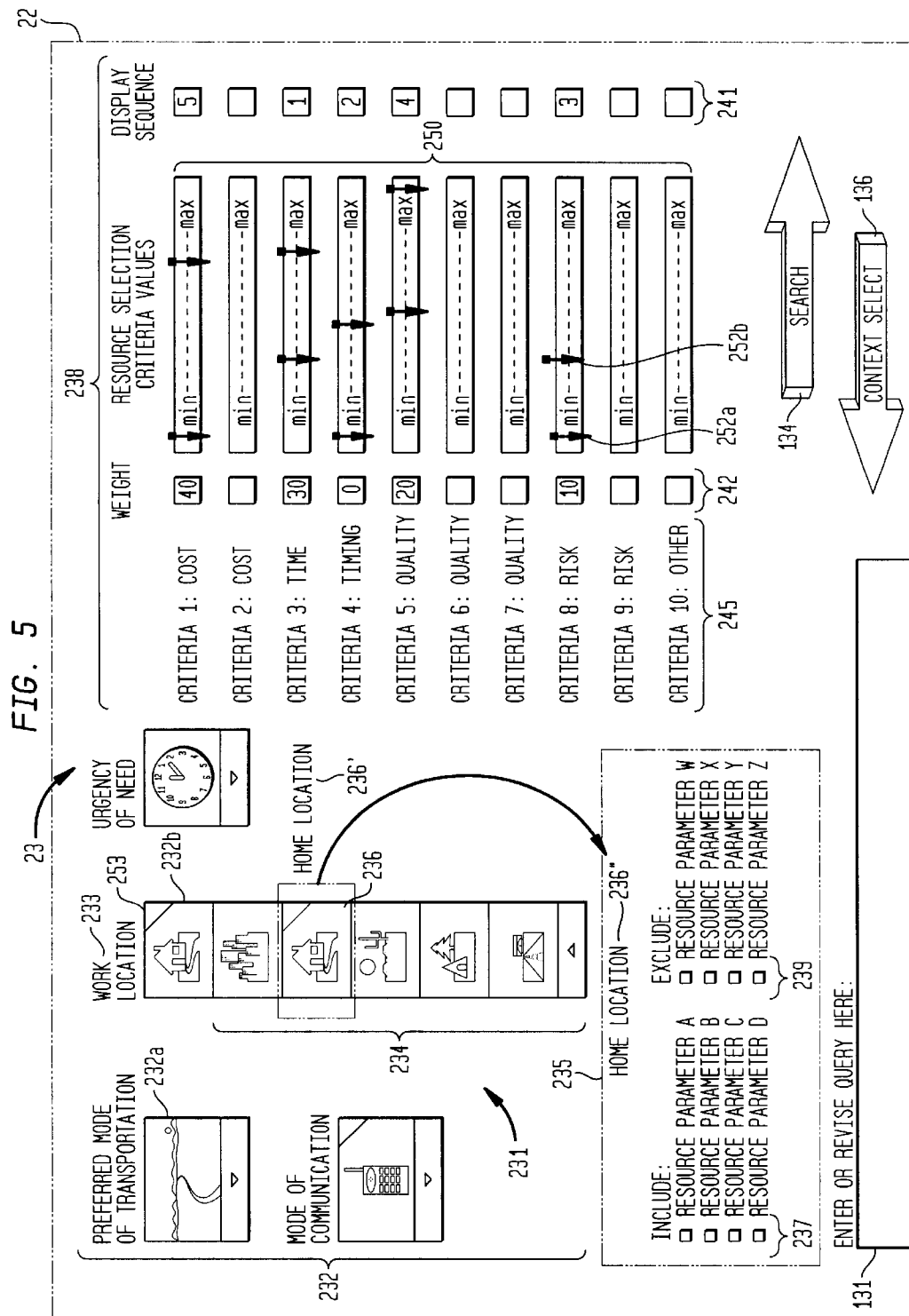




FIG. 6

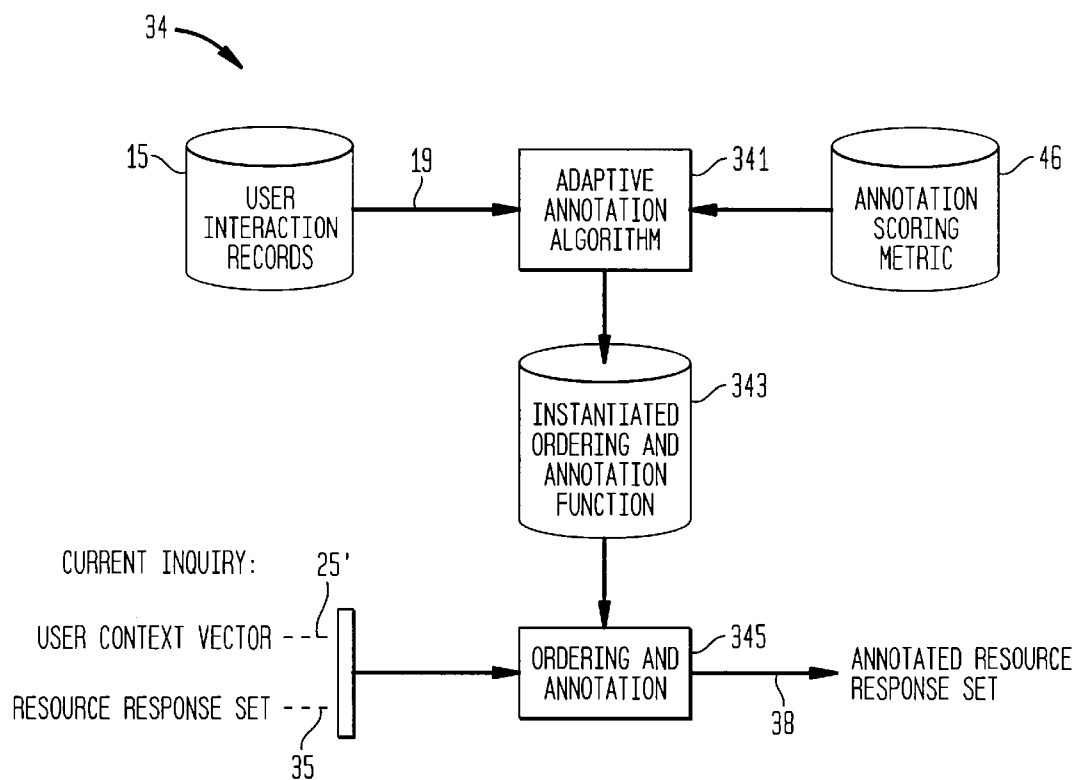
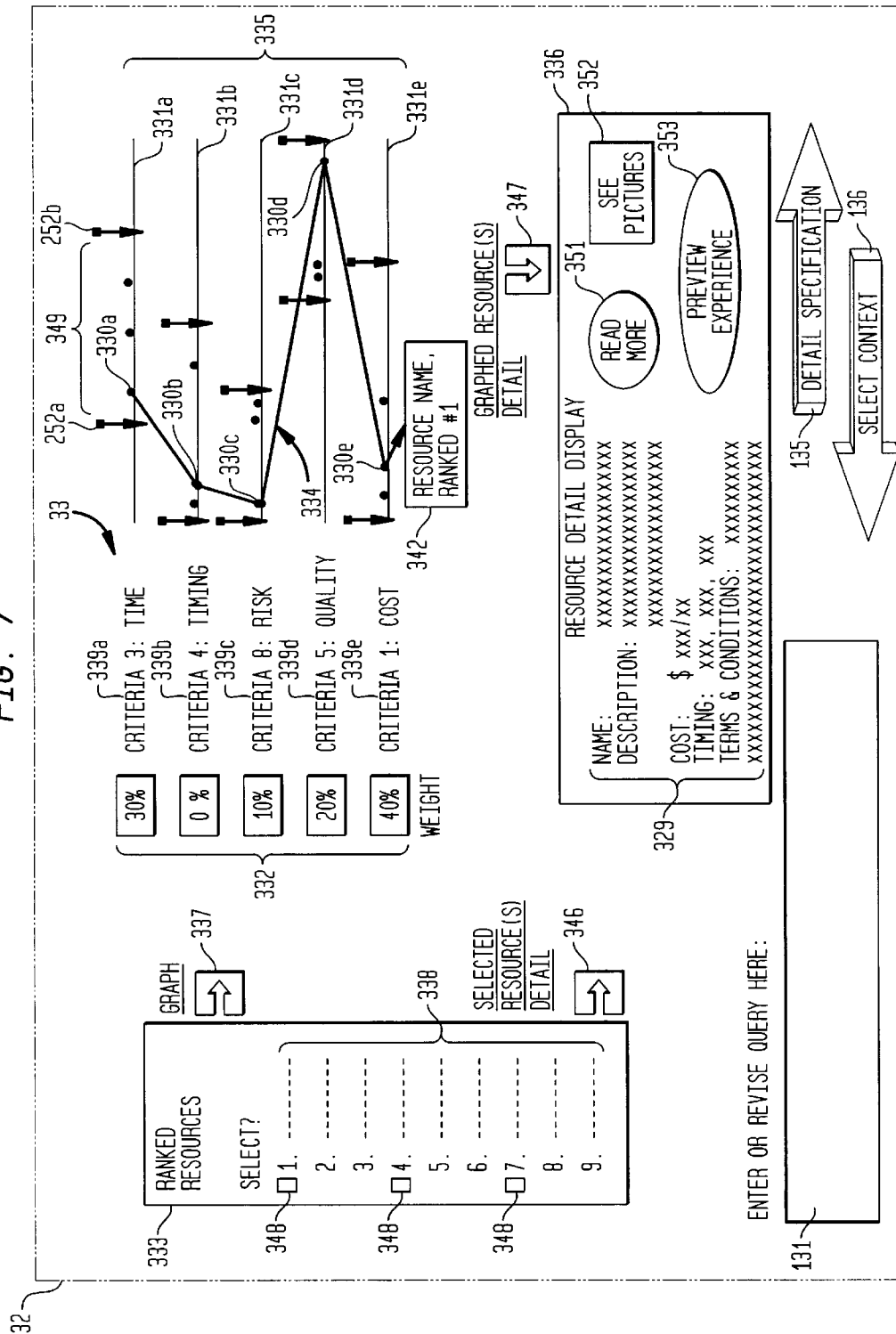


FIG. 7



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## CUSTOMER SELF SERVICE SUBSYSTEM FOR RESPONSE SET ORDERING AND ANNOTATION

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

This invention relates generally to the field of customer self service systems for resource search and selection, and more specifically, to a novel mechanism for annotating response sets via an adaptive algorithm, wherein the annotations supplied are used to drive any visualization system that presents resource response results.

#### 2. Discussion of the Prior Art

Currently there exist many systems designed to perform search and retrieval functions. These systems may be classified variously as knowledge management systems, information portals, search engines, data miners, etc. However, providing effective customer self service systems for resource search and selection presents several significant challenges. The first challenge for current systems with query capability is that serving queries intelligently requires a large amount of user supplied contextual information, while at the same time the user has limited time, patience, ability and interest to provide it. The second challenge is that searching without sufficient context results in a very inefficient search (both user time and system resource intensive) with frequently disappointing results (overwhelming amount of information, high percentage of irrelevant information). The third challenge is that much of a user's actual use and satisfaction with search results differ from that defined at the start of the search: either because the users behave contrary to their own specifications, or because there are other contextual issues at play that have not been defined into the search. The prior art has addressed the use of some of the features of the resources (content and other) in relation to the user's context and/or prior use of other resource search and selection systems, for selection of responses to current user's queries. Representative prior art approaches systems described in U.S. Pat. No. 5,724,567 entitled "System for Directing Relevance-Ranked Data Objects to Computer Users"; U.S. Pat. No. 5,754,939 entitled "System for Generation of User Profiles For a System For Customized Electronic Identification of Desirable Objects"; and, U.S. Pat. No. 5,321,833 entitled "Adaptive Ranking System for Information Retrieval".

U.S. Pat. No. 5,321,833 describes an adaptive record ranking method for full text information retrieval, which quantifies the relevance of retrieved records to query terms occurring in the record. The method utilizes a multilevel weighting technique which permits user input to affect record weighting at each level of the ranking process. The method utilizes weighted attributes of properties of terms occurring in the records of a database and compensates for the distance between adjacent words of complex terms. The method has been implemented on large full text databases and the resulting rankings achieve a relatively high level of precision in ranking the relevance of retrieved records to a user query. However, this method does not take into account user context data, and thus is not specialized based on a user situation within the whole system.

U.S. Pat. No. 5,724,567 describes an information access system that stores items of information in an unstructured global database. When a user requests access to the system, the system delivers to that user an identification of only those items of information which are believed to be relevant

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to the user's interest. The determination as to the items of information that are relevant to a user is carried out by ranking each available item in accordance with any one or more techniques. In one approach, the content of each document is matched with an adaptive profile of a user's interest. In another approach, a feedback mechanism is provided to allow users to indicate their degree of interest in each item of information. These indications are used to determine whether other users, who have similar or dissimilar interests, will find a particular item to be relevant.

For instance, U.S. Pat. No. 5,754,939 describes a method for customized electronic identification of desirable objects, such as news articles, in an electronic media environment, and in particular to a system that automatically constructs both a "target profile" for each target object in the electronic media based, for example, on the frequency with which each word appears in an article relative to its overall frequency of use in all articles, as well as a "target profile interest summary" for each user, which target profile interest summary describes the user's interest level in various types of target objects. The system then evaluates the target profiles against the users' target profile interest summaries to generate a user-customized rank ordered listing of target objects most likely to be of interest to each user so that the user can select from among these potentially relevant target objects, which were automatically selected by this system from the plethora of target objects that are profiled on the electronic media.

A major limitation of these prior art approaches, however, is the absence of a mechanism for implementing user context in informing the ranking of the resources. Moreover, these prior art approaches are limited in that they do not enable user tutoring of the application for ranking information. That is, prior art approaches do not provide for the adaptation or changing the ranking over time, for example, based on a history of user interactions with the system. Another major limitation of the prior art is that these systems do not annotate the response sets via an adaptive algorithm and moreover, do not use the resulting annotations to drive visualization systems.

It would be highly desirable to provide for a customer self service system, a mechanism that annotates query response sets via an adaptive algorithm and wherein the annotations the mechanism supplies may be used to drive any visualization system.

### SUMMARY OF THE INVENTION

It is an object of the present invention to provide for a customer self service system for resource search and selection a mechanism for supplying annotations to a set of query response sets via an adaptive algorithm.

It is a further object of the present invention to provide for a customer self service system for resource search and selection an annotation mechanism for annotating query response sets wherein the annotations affect the order that these resources are presented to the user.

It is another object of the present invention to provide for a customer self service system for resource search and selection, an annotation mechanism for annotating query response sets wherein the annotations provided affect the order that these resources are presented to the user and wherein the ordering is based on features of the resource itself when viewed through the user's context.

It is yet another object of the present invention to provide an annotation function for a customer self service system for resource search and selection that implements a supervised

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learning algorithm wherein training data utilized for this algorithm is derived from prior user interactions and the annotation function is optimized based on an annotation scoring metric.

According to the invention, there is provided a system and method for annotating resource results obtained in a customer self service system that performs resource search and selection. The method comprising the steps of: receiving a resource response set of results obtained in response to a current user query and receiving a user context vector associated with the current user query, the user context vector comprising data associating an interaction state with the user; applying an ordering and annotation function for mapping the user context vector with the resource response set to generate an annotated response set having one or more annotations; and, controlling the presentation of the resources response set to the user according to the annotations, wherein the ordering and annotation function is executed interactively at the time of each user query.

Further, in an off-line process, a supervised learning algorithm is implemented for receiving user interaction data from among a database of user interaction records and an annotation scoring metric representing a measure of performance in locating resource response results displayed via a graphical interface. The algorithm generates ordering and annotation functions which are adaptable based on history of user interactions as provided in the database of user interaction records. The result of this invention is the ability to drive any visualization system for presenting resource response results in the most beneficial and meaningful way to the user via an interface when performing search and resource selection.

Advantageously, such a system and method of the invention is applicable for a customer self service system in a variety of customer self service domains including education, real estate and travel.

### BRIEF DESCRIPTION OF THE DRAWINGS

Further features, aspects and advantages of the apparatus and methods of the present invention will become better understood with regard to the following description, appended claims, and the accompanying drawings where:

FIG. 1 is a flowchart showing the steps of the control flow between the components comprising the customer self service system according to the invention.

FIG. 2 is a flowchart showing the generic process steps of the user's interaction with the customer self service system through various iconic interfaces.

FIG. 3 provides examples of data elements from the education, real estate and travel domains given example user interactions with the customer self service system via the iconic interfaces.

FIG. 4 illustrates the first iconic Graphical User Interface 12 including the Context Entry Workspace 13.

FIG. 5 illustrates the second iconic Graphical User Interface 22 including the Detail Specification Workspace 23.

FIG. 6 is a flowchart depicting the methodology for adaptive response ordering and annotation according to the preferred embodiment of the invention.

FIG. 7 illustrates in detail the third iconic graphical user interface 32 including the Results Display Workspace 33 that enables the user to visualize and explore the response set that the system has found to best match the user's initial query and related subject and context variables.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a customer self service system ("system") 10 which is described in detail commonly-

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owned, co-pending U.S. patent application Ser. No. 09/778, 146 entitled CUSTOMER SELF SERVICE SYSTEM FOR RESOURCE SEARCH AND SELECTION the contents and disclosure of which are incorporated by reference as if fully set forth herein. The system 10 is a comprehensive self service system providing an end-to-end solution that integrates the user and system, the content and context, and, the search and result so that the system may learn from each and all users and make that learning operationally benefit all users over time. The present invention comprises a particular aspect of this system that focuses on annotating a set of response resources by implementing a supervised training algorithm. Particularly, the present invention is directed to a response set ordering and annotation sub-process that generates annotations that affect, among other things, the order that these resources are presented to the user of the resource search and selection system. The ordering is based on features of the resource itself when viewed through the user's context.

Particularly, as shown in FIG. 1, the self service system provides a three-part intuitive iconic interface comprising interface components 12, 22 and 32 for visualizing and exploring the set of resources that the system has found to match the user's initial query and related subject and context variables. The system 10 preferably enables the expression of a user's context as part of the query and expresses the relevance of the results to a particular user via the interface in terms beyond that of the results' content. The resource set is presented to the user in a way which clearly illustrates their degree of fit with the user's most important context variables, as indicated by their prior usage of the system, as well as by context choices for the current query. The system displays the resources in the sequence specified by the user and enables the user to select and weight the criteria to be used in interpreting and selecting between resources. This provides a shifting of the user's focus from finding something, to making choices among the set of resources available. Via the interface components 12, 22 and 32, the user may redefine their query, preview some or all of the suggested resources or further reduce, and redisplay the response set to extract those with the best degree of fit with that user's current needs. The system generates and displays via the interface a listing of the currently active inclusionary and exclusionary content filters and provides a means for modifying them. More specifically, the intuitive user interface of the invention enables users to specify the variables of their resource needs.

FIG. 2 particularly depicts reduced-size displays illustrating the three iconic user interfaces 12, 22, 32 which comprise the respective workspaces according to the invention. As will be described in greater detail herein, the first graphical user interface 12 comprises an initial Context Selection Workspace 13 that enables the expression of user context as part of a query in a manner optimized for ease of use; the graphical user interface 22 shown in FIG. 2 provides a Detailed Specification Workspace 23 including a visual representation of multi-dimensional data for expressing query and results that enables users to completely manage their search in a manner optimized for simplicity and clarity of logic; and, the graphical user interface 32 is directed to a Results Display Workspace 33 that enables expression of relevance of results in terms of user context in a manner optimized to facilitate resource selection using user supplied decision criteria. Aspects of interfaces 12, 22 and 32 shown in FIG. 2 are described in greater detail in commonly-owned, co-pending U.S. patent application Ser. No. 09/778, 136 entitled CUSTOMER SELF SERVICE ICONIC

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INTERFACE FOR PORTAL ENTRY AND SEARCH SPECIFICATION and commonly-owned, co-pending U.S. patent application Ser. No. 09/778,147 entitled CUSTOMER SELF SERVICE ICONIC INTERFACE FOR RESOURCE SEARCH RESULTS DISPLAY AND SELECTION, the contents and disclosure of each of which are incorporated by reference as if fully set forth herein.

Referring back to FIG. 1, there is depicted a conceptual control flow 10 for the customer self service resource search and selection system according to a preferred embodiment. Via the three-part intuitive graphic user interface (GUI) users are enabled to enter queries and manipulate the system's responses according to their resource needs. Behind the scenes, as will be described, is a set of sub-system components that cooperate to derive, assume, sense and infer particular user contexts with minimal user effort.

These components include databases such as: 1) a Context Attributes Master database 14 which stores the definitions of all the attributes known to the system and their relationships to predefined user contexts; 2) an Attribute Value Functions database 16 which stores the definitions and logic associated with assigning a value to an attribute for specific instances (context default, groups of users); 3) a Resource Indexing Functions database 18 which stores the definitions and logic for mapping specific resources to specific context sets; and, 4) a historical User Interaction Records database 15 which stores the users' prior queries, responses, and interactions with the system 10. The first three databases are created before system startup and the User Interaction Records 15 is created with the first user/use of the system, however, it is understood that all four databases are maintained and enhanced through system operations described below.

First, prior to a user signing on to the system, and before the user first views the iconic interface 12, the system 10 performs several pre-processing steps including: 1) creating of an empty "user context vector" 25 and populating the context vector with minimal information from external data elements 11 integrated with the system or, from system sensing/discovery; and, 2) processing the minimal user context vector 25 against the Context Attributes database 14, the Attribute Value Functions database 16, and the User Interaction Records database 15 using context classification logic to result in a "suggestion" that this particular user may be classified into one of a small number of user context definitions from the system's predefined long list of context definitions. After these pre-processing steps, the first iconic interface 12 is then displayed for the user at the user's terminal, or web-browser, in the case of resource searches conducted over a web-based communication link. The iconic Context Selection Workspace 13 initially displays a small set of User Context Icons it has determined are most appropriate, captures the user's selection of the one that seems most fitting for the current user search session, and captures the user's actual query. In most cases, this minimal entry will suffice to begin the search because the system has already determined the relevant attributes, default values and parameters to drive the system forward through the user search without any additional entry on the user's part. However, if the user wishes to review their defaults or to fine tune some context or resource variables, there is an option to proceed to the iconic Detailed Specification Workspace display 22 before starting the search.

Regardless of the screen navigation path chosen, when the user initiates the query, the system 10 packages the user query with a detailed User Context Vector 25 summarizing what is known of the user's needs at this point. Once the search is initiated, the query and context vector are pro-

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cessed sequentially through three distinct sub-processes: 1) the Classifying User Contexts sub-process 24 according to the invention; 2) an Adaptive Indexing of Resource Solutions and Resource Lookup sub-process 28; and, 3) a Response Set Ordering and Annotation sub-process 34 according to the invention.

Particularly, the Classifying User Contexts sub-process 24, receives as input the user query and the raw context vector 25 and External User Data 11, and processes these against the User Interaction records 19 for this user/user group, data from the Context Attributes Master 14 and Attribute Value Functions 16. The system classifies this specified user interaction state and annotates the context vector 25' with a complete set of context parameters for use in subsequent processing. The Classifying User Contexts sub-process 24 particularly applies an inductive learning algorithm as an attempt to predict derived contexts. Additionally, the Classifying User Contexts sub-process 24 updates the Attribute Value Functions database 16 with more enhanced functions. The actual processing via Context Classifier and Context Applier is described in greater detail in commonly-owned, co-pending U.S. patent application Ser. No. 09,778,378 entitled CUSTOMER SELF SERVICE SUBSYSTEM FOR CLASSIFYING USER CONTEXTS, the contents and disclosure of which are incorporated by reference as if fully set forth herein.

As the customer self service system is provided with functionality enabling a user to "bookmark" their stopping point in a prior session and to resume with a "work-in-process" data set, the initial settings may be modified based upon system discovery or user override at the time of inquiry, resulting in the raw contexts associated with the user's current inquiry transaction. It is this raw context data which serves as input to the context classifier sub-process 24.

The Adaptive Indexing of Resource Solutions and Resource Lookup sub-process 28 receives as input the user query and the context vector 25' and processes them against a Resource Library 42, the User Interaction Records for this user/user group 19, and the Resource Indexing Functions 27. This sub-process particularly maps specific contexts to specific resources so as to increase the relevance of search results for a given user in their current context without requiring the user to explicitly train the system. The primary output of the Adaptive Indexing of Resource Solutions and Resource Lookup sub-process 28 is a newly identified Resource Response Set 35 which is input to the Response Set Ordering and Annotation sub-process 34. The Adaptive Indexing of Resource Solutions and Resource Lookup sub-process 28 additionally generates a secondary output which comprises updates to the Resource Indexing Functions database 18 with yet more enhanced functions 27'. Further details regarding the Adaptive Indexing of Resource Solutions and Resource Lookup sub-process 28 may be found in commonly-owned, co-pending U.S. patent application Ser. No. 09,778,135 entitled CUSTOMER SELF SERVICE SUBSYSTEM FOR ADAPTIVE INDEXING OF RESOURCE SOLUTIONS, the contents and disclosure of which are incorporated by reference as if fully set forth herein.

According to the invention, Response Set Ordering and Annotation sub-process 34 receives as input the User Context Vector and Resource Response Set 35 and processes it against data from an Annotation Scoring Metric database 46 and User Interaction Records 19 for the particular user/group. This sub-process 34 weights and ranks the potential responses according to the resource selection criteria speci-



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fied by the user on the Detailed Specification Workspace described herein, and takes into consideration the scoring metric. The sub-process **34** additionally tags the response set with data elements necessary for display and manipulation on a visualization system, including, but not limited to, the Results Display Workspace **32** described in the co-pending U.S. patent application Ser. No. 09/778,147, and particularly generates as output an Annotated Resource Response Set **38**.

More particularly, FIG. 6 is a flowchart depicting the response ordering and annotation sub-process methodology **34** for ordering a result set according to the preferred embodiment of the invention. As shown in FIG. 6, the User Interaction Records **19** (which include the actual resources selected by the users and the annotation schemes used to present them) and the Annotation Scoring Metric **46** are input to an Adaptive Annotation Algorithm **341** which is a supervised learning algorithm that generates functions for optimally annotating the response set for ease of use as defined by the Annotation Scoring Metric. For the purpose of this invention the terms rule and function are used interchangeably. Both refer to any data structure that can be executed by an interpreter in a way as to compute a set of labeled output values given a set of labeled input values. An example of an arithmetic rule is "Fahrenheit<-Centigrade\*5/9+32". Rule languages include but are not limited to: neural nets, decision trees, functional languages, polynomial functions. User Interaction Records **15** particularly comprises traces of previous interactions with users of the system including: all types of raw context information that were available during those interactions, whether it be static, historical, or transient, organizational or community context, environment context, or any other context associated with the user and dependent upon that user's interaction state and query domain, e.g., education, real estate, travel, etc. user queries, the system's responses, and, in addition, user feedback generated by the user regarding the resources that were provided during those sessions. User feedback, for example, may include a specification of which resource was chosen by the user given a list of displayed resources. The Annotation Scoring Metric **46**, for example, may include a parameter representing the measure of "goodness" in terms of how easily the user may find the resources in the response set **35**. As another example, the Annotation Scoring Metric **46** may be set up to penalize an annotation which does not make it "easy" for the user to find the resources in the response set, i.e., a metric that places most of the resources ultimately selected by the user on a second screen on the user interface or at the bottom of the first screen. As another example, one measure of performance is closeness of the selected items to the top of the response set (assuming that the annotations of the response set specify an ordering of the response set).

Each of the user interaction records and annotation metric serves as a training set for learning an ordering and annotation function **343**. That is, the adaptive annotation algorithm **341** is implemented to optimize the annotation function **343** as measured by the feedback in the received interaction records **19**. That is, the annotation function **343** accepts an annotated list of resources, along with the user interaction records associated with the interactions that happened when this annotated list was presented to the user and returns a real value representing the performance of that annotation. For example, an annotation evaluation metric of a score computed by counting how far down from the top of the list was the user's selection given the annotation. Thus, according to this metric, a given annotation set would get the highest possible score if it had placed the resource event-

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ally selected by the user at the top of the list of resources presented to the user. It should be understood that this adaptive process **341** need not be interactive, but may be performed in batch or off-line.

The sub-process methodology **34** further includes an ordering annotation step **345**, during which the ordering and annotation function **343** which comprises the functions to be used in mapping the user context vector **25'** with the resource response set **35** in order to generate an annotated response set **38**. It is understood that the ordering and Annotation step **345** is executed interactively, e.g., at the time of every user query. It is the application of the ordering and annotation function **343** to the user context **25'** and resource response set **35** that result in the annotations **38** for the responses in the input response set, which annotations control the presentation of the resources to the user. As an example, these annotations may include ordering, which resources to bold, which would be placed on the primary screen of query results seen by the user and which would be placed on a secondary screen requiring an additional step by the user such as clicking on a button "give me additional resources", which resources to gray out, etc.

As mentioned, the ordered and annotated set of resources that the system has found to best match the user's initial query and related subject and context variables may be displayed through any visualization system, including, but not limited to, the intuitive iconic interface **32** for visualizing and exploring the response set. In that case, the annotations **38** specifically are used to inform the iconic user interface **32** (FIG. 7) what resources to display in response to the query and how to display them.

FIG. 7 illustrates in detail the third iconic graphical user interface **32** described in greater detail in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,147. As shown in FIG. 7, the graphical user interface **32** is divided into the following sections: a section for displaying the Query Entry field **131** as entered on the prior interface screen (FIG. 4) and available for editing; a section for displaying a navigation arrow **135** for enabling the user to proceed back to the Detailed specification Workspace **23** of FIG. 5, and arrow **136** for returning to the initial Context Selection screen via the first iconic interface to initiate a new query or select a different user context; and, a Results Display Workspace **33** that enables the user to visualize and explore the response set that the system has found to best match the user's initial query and related subject and context variables and that enables the user to continue working to learn about the resources suggested (detail/preview), narrow their results (selection) or re-display them in a more meaningful view for decision making (graphically).

The Results Display Workspace **33** particularly includes a graphic element **333** which comprises a list of ranked resources **338** returned by the user's query. Via this graphic element, the user is provided with ability to select via checkboxes **348**, for example, one or more resources for viewing of additional details. The response set **338** is ranked by the aggregate value and weighting defined by resource selection criteria and value ranges as described herein.

As shown in FIG. 7, the Results Display Workspace **33** displays the weighting **332** for each of the available resource selection criteria **339a**, . . . , **339e**. The choices of weighting and selection of resource selection criteria are made on the Detail Specification Workspace described generally herein with respect to FIG. 5. Preferably, the system generates for display in the Results Display Workspace **33** a multidimensional plot **335** comprising one or more axes, e.g., **331a**, . . . ,



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**331e**, with each axis corresponding to each previously specified results selection criterion such as cost **339e**, time **339a**, timing **339b**, quality **339d** and risk **339c**. The plot is initiated in response to user selection of graph icon **337**, and the user's selection of one or more resources **338** from the displayed list **333** of ranked resources. Each axis **331a**, . . . , **331e** is displayed in the sequence specified by the user in the detail specification workspace **23** and includes one or more data points **349** corresponding to each resource **348** selected from the list **333**. Each data point represents the value of the particular resource selection criteria represented by the axis for that resource. As the user moves his/her mouse over a data point resource on one of the axes **331a**, . . . , **331e**, for example, data point **330a** on axis **331a** in FIG. 7, the resource represented by that data point is visually connected, e.g., by line **334**, to all the other points for that same resource, e.g., points **330b**–**330e**. Additionally, in response to such showing, the values for all the resource selection criteria and name and rank of the resource **342** is displayed. It is understood that the locations of the data points **349** on each axis reside between the minimum and maximum resource selection criteria values indicated by the slider bars **252a**, **252b** as previously set by the user in the detailed specification workspace **23** of FIG. 5.

The interface **32** is additionally provisioned with an icon **346** selectable for initiating the display of a Resource Detail Display portion **336** shown in FIG. 7, which is a graphical element used to provide further details or previews of the resources **338** selected from the list of ranked resources **333**. Besides providing a text description **329** of the resource, including name, cost, timing, and terms and conditions, the graphical element **336** may be provided with hyperlinks **351**–**353** enabling the user to read more details regarding the resource, see pictures of the resource, or preview the resource, respectively. It should be understood that icon **337** for viewing the graph or the icon **346** for viewing detailed descriptions of the actual resources are independently selectable.

As further shown in FIG. 7, the user has the additional option **347** to view a detailed description of a currently plotted resource highlighted or shown in the graphic portion **335**. The detailed description of a currently plotted resource is displayed via the Resource Detail Display portion **336**.

As the user works with the system, particularly through the Results Display Workspace **33** (FIG. 7) and the Detail Specification Workspace **22** (FIG. 5) his/her interactions are captured and stored in the User Interaction Records database **15**. Thus, in addition to the user query, context vector and response data set, the system retains adjustments to user context, results display manipulation, and results viewing and selection behavior **51**.

Having completed the transaction, there is one more sub-process which is essential to this system: the sub-process for Context Cluster Discovery and Validation **48**. This batch process, occurring asynchronously and constantly, applies unsupervised (machine) learning to cluster user interaction records and to assist in the identification of new user contexts, attribute value functions and resource indexing functions. The User Interaction Records **19** are processed against the Context Attributes Master database **14**, the Attribute Value Functions database **16** and the Resource Indexing Functions database **18** and a Distance Metric **44** which helps determine “how close is close”, i.e., “what’s good enough” for a variety of factors. When validated by a system administrator, additional user contexts may be implemented (manually or semi-automatically) in the databases and visibly as new icons on the Context Selection Workspace **13**.

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Attribute functions may also be identified and resource indexing functions may be discovered and updated in the appropriate files automatically. All of these additional classifications improve the ease of use, accuracy, and predictability of the system over time. Further details regarding the Context Cluster Discovery and Validation sub-process **48** may be found in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,149 entitled CUSTOMER SELF SERVICE SUBSYSTEM FOR CONTEXT CLUSTER DISCOVERY AND VALIDATION, the contents and disclosure of which are incorporated by reference as if fully set forth herein.

The customer self-service system and the interaction with the system through the iconic interfaces of FIGS. 2, 4, 5 and 7, will now be described with respect to example domains such as education, travel and real estate, and further will be described from the point of view of the following users: a learner, a traveler and a real estate transactor, e.g., renter/buyer. In describing the user's interaction with the system through the iconic interfaces, a set of data elements used in the system and their characteristics are first defined as follows:

Query: an entry field for entering search data by using text or voice methods, for example, but not limited to these methods

User Context: a User Context represents a predefined set of context attributes which are relevant to the search behavior/needs of a group of people.

More particularly, the User Context enables the packaging of a rich set of attributes about the user with a rich set of attributes about their searching and execution environment in response to “one click” of an icon for the user presented via the interface. While there are potentially a large number of potential user contexts for any user population, each individual user would likely settle on a small number that apply to them in different circumstances. The naming of these contexts is important so that the user may recognize him/herself as potentially fitting into that group. The attributes associated with a particular user context are predefined by system administration and cannot be modified by the user. Over time, by implementing the Classifying User Context sub-process **24** (FIG. 1), the system will identify changes to the attribute set that will make a particular user context perform better for its repeated users. Over time the system will detect different attribute sets which appear to predict user needs/behaviors and might suggest new user contexts for the system.

Context Attribute: An attribute is used to describe a characteristic associated with the User Context.

There are potentially an unlimited number of attributes defined to the system with a master list maintained in the Context Attributes Master File. New attributes are discovered and added with system administrator validation. End users may not modify the definition of a context attribute, nor its’ packaging into user contexts, nor the list of values associated with each.

Attribute Value: A list of attribute value choices is predefined for each context attribute.

The system sets a default value to each attribute based upon data lookup, sensed, or historically derived from prior user entry or behavior. Either the system or the user may modify the value initially set based upon explicit preferences or observed behavior. This value is added to the context vector used for resource lookup, and is retained in the historical User Interaction Records database **15** so it may be used to set default values for each individual each time they use the system.

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Value Resource Parameters: Parameters defined in terms of inclusion and exclusion that may be used as a filter to increase the relevance of the response set.

That is, with the basic search logic established, the user's query may be satisfied. However, the response set may contain a large number of resources which are not satisfactory to this individual. Value Resource Parameters defined in terms of inclusion and exclusion may be used as a filter to increase the relevance of the response set. The inclusionary parameters may be easier to establish by users new to the system and that exclusionary parameters will become more evident as users gain experience in working with the response sets.

Resource Selection Criteria and Value Ranges: Parameters and specifications for ranking a user's response set to enable more informed resource selection.

Thus, even with the degree of specificity enabled by the system, and even with the constant improvement in search relevance/efficiency as it relates to user contexts, there usually may be more than one resource to present to the user (in fact, if the search is too narrow, the user may miss the opportunity to explore/discover different approaches to meeting their actual needs). As most users know (or think they know) the criteria they will apply to selecting between options, a limited set of resource selection criteria are provided by the system (the set would differ by domain). However, via an interactive graphical display provided by the iconic interface of the invention, the user may now specify acceptable value ranges and relative weighting of each criteria for ranking their response set and/or may customize the use of these criteria.

When the actual response set data is offered, most users face the reality of many options, few options, more subjective information about specific resources; and they may make tradeoffs around the selection logic. For example, the response set may be refreshed as the user may decide to eliminate a criteria, change the weight of a criteria, or change the acceptable value ranges for a criteria. From these specifications, accessible via the iconic interface of the invention, the user may determine for example, whether time, timing, flexibility, and risk may be sacrificed in order to bring the cost down below a certain dollar (\$) value, and, for example, determine how much more would the user need to pay to get exactly what he/she wants exactly when he/she wants it.

FIGS. 2, 4, 5 and 7 depict in greater detail the iconic interfaces for the customer self service system that enable the use of a rich set of assumed, sensed, inferred, and derived contexts with minimal user effort.

With initial logon, as shown in FIG. 2, the system first presents a set of user contexts which are available to the user via the simplified iconic interface 12 of FIG. 2. The system will suggest one context over the others, but the user may select the one most appropriate to their current situation. In each session, the user selects only one user context to use, however over time each user may discover that a couple of different user contexts serve their needs in differing circumstances. On this screen 13 particularly, the user then enters a query via one or more methods including text via a web browser display interface, for example, or via voice, for example, with help of voice recognition software. It should be understood however, that query entry is not limited to these types of methods. The user will then initiate a lookup and proceed either to a third process step (via most direct path 52) for viewing a search result response set via the Results Display Workspace interface 32, or, proceed to a second step (via path 50) to optionally refine/override search variables via the Detail Specification Workspace interface 22.

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FIG. 4 illustrates in detail the first graphical user interface 12 including the initial Context Selection Workspace 13 that enables the expression of user context as part of a query. As shown in FIG. 4, the Context Selection Workspace 13 includes: a series of one or more selectable User Context Icons 132 presented to the user for selecting user contexts; and, a Query Entry Field 131 enabling user entry of search terms via text or voice entry, for example. In accordance with the principles of the invention, the User Context Icons 132 are graphical user interface elements from which the user selects the one context most representative of his/her current situation. The icons presented in this interface each represent a packaging of sets of attribute-value pairs which describe a kind of user in a particular situation. Particularly, a user context represents a predefined set of context attributes which are relevant to the search behavior/needs of a group of users. For example, as described herein, context may include aspects of the user's knowledge, their relationship to organizations and/or communities, their user environment(s), and their resource need. All of these combine to provide a rich context surrounding the actual query which can significantly improve the outcome of the search through resources.

The Context Selection Workspace 13 thus enables the expression of user context as part of the query and is optimized for ease of use. Particularly, the user selects from one or more of the several displayed context icons 132 by clicking on them. A context "applier" pre-process described in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,378 is invoked at each session initiation for a user's search transaction, using a minimal or null user data set to produce defaults for user context, attributes, values, and resource parameters for the initial display of the Context Selection Workspace 13. This pre-processing step delivers additional benefits to the user by ensuring the use of the most current data and functions operating in the system. After making the initial query entry, by selecting hyperlink 134, the user is able to initiate the search and proceed directly to the third interface 32 which displays the actual search results. Alternately, by selecting hyperlink 135, the user may proceed to the second interface 22 having the Detail Specification Workspace 23 for further query editing and/or context refinement.

Returning to FIG. 2, with respect to the second step, the user is able to fine tune or override context attribute values, value resource parameters, and resource selection criteria and value ranges, using a drag and drop interface, iconic pulldowns, and/or slide buttons. The user may return to this screen as many times as needed to find a suitable response set. Particularly, via the second iconic interface 22, the User Context selected in the first step has been made explicit by its default settings on all the iconic interface elements listed. Thus, via a Detail Specification Workspace 23 the user may: 1) modify the query (via text entry or voice, for example); 2) change the value of attributes associated with the user context (using pull down menus); alter the value resource parameters (e.g., include/exclude) using checkboxes; 3) customize the subset of responses by altering the resource selection criteria, including the weighting of criteria and the ordering of criteria on the final display, (e.g., using checkbox and/or numeric entry); and, 4) further refine the selection by specifying minimum/maximum acceptable value ranges for resource selection criteria through drag and drop of "tabs" on sliders, for example. After making the necessary adjustment, the user re-initiates the lookup and may proceed to the third step via path 51.

FIG. 5 illustrates in detail aspects of the second iconic graphical user interface 22 which enables the user to define

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or change all the parameters associated with their query **131** and (single) selected user context **132**. As shown in FIG. 5, the graphical user interface **22** is divided into the following sections: a section for displaying the Query Entry field **131** as entered on the prior interface screen (FIG. 4) and available for editing; a section for displaying navigation arrows which allow the user to proceed with the search **134**, or return to the initial Context Selection screen **136** via the first iconic interface to initiate a new query or select a different user context; and, a Detailed Specification Workspace **23** which is where all the search parameters can be explicitly viewed and modified. There are only two things the user cannot change from this screen: the user context selected (which they may change only on the Context Selection screen) and the context attributes which are linked to the user context (and which are predefined in the Context Attributes Master database **14**).

As shown in FIG. 5, within the Detailed Specification Workspace **23** there comprises: an Attribute-Value Workspace **231**, for enabling the user to change the attribute values for all the context attributes, represented as graphic elements **232**, associated with the selected user context icon **132** (FIG. 4); and, a Resource Selection Criteria Workspace **238**, for enabling the user to define the criteria **245** to be used in evaluating resources, define minimum and maximum acceptable values provided on slider elements **250** corresponding to each criteria, specify the weight assigned to those criteria via selection boxes **242**, and specify the positioning of those criteria in a graphical display of the resources selected via selection boxes **241**. As will be described, FIG. 3 provides sample data for the context attribute, attribute value, value resource parameters, and partial resource selection criteria from different domains which may be represented in the Detailed Specification Workspace **23**.

With more particularity, the Detailed Specification Workspace **23** additionally includes the Value-Resource Parameter Workspace **235**, for enabling the user to change or create resource parameters using include logic **237** or exclude logic **239** for any attribute value **232** selected in the Attribute-Value Workspace **231**. More specifically, the Attribute-Value Workspace **231** includes graphical representations of all the context attributes **232** associated with the single (currently active) selected user context **132**. Each context attribute **232** is displayed with a text title **233** for the attribute. The currently active attribute value for that context attribute is shown on each context attribute icon. In addition, if the user has substituted, as described below, a context attribute value different than the default value provided for this user session, a marker **253** is displayed on the corner of the context attribute icon. If the user "mouse clicks" on the context attribute element, e.g., icon **232b**, the system displays a pull down menu **234** of graphic elements showing all the possible attribute values for this context attribute. If the user "mouses over" any of the values from pull down menu **234**, e.g., attribute value **236**, a textual description **236'** supporting the element may appear. By selecting a context attribute element from the pull down menu **234**, e.g., element **236** shown highlighted in FIG. 5, the user is enabled to fine tune their selected context based upon their current situation. If the user "mouse clicks" on a value other than the current default, the new value is "selected" to substitute for the default. If the user "double clicks" on the attribute value, the system prepares the Value-Resource Parameter Workspace **235** for this single attribute value, as will be described. FIG. 3 provides sample data for context attributes and attribute values from different domains which may be represented in the Attribute Value Workspace **231**.

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In the Value-Resource Parameter Workspace **235**, the user may change or create resource parameters using include logic or exclude logic for any context attribute value **232** selected in the workspace **231**. Regarding FIG. 5, with more particularity, the Value-Resource Parameter Workspace **235** is displayed for one attribute value at a time and is only displayed when requested via a double click, for example, on one of the attribute values displayed in the attribute Value Workspace **231**, e.g., attribute value **236**. The Value-Resource Parameter Workspace **235** is a pre-formatted two-column space (dialog box) where the user may establish inclusionary resource filters via checkboxes **237** and/or exclusionary resource filters via checkboxes **239**, based upon pre-established resource characteristics **236"** for that selected attribute value. The value resource parameter data elements are pre-set by the user's know context, prior history of selecting from resources identified by the system, and potentially by corporate/organizational policy implemented through the system. By making these additional specifications, the user is enabled to increase the relevance of the resource response set based upon their current situation and personal preferences. When finished with these specifications, the user may double click to close this box **235** and return to the Attribute Value Workspace **231**. This step can be repeated for as many attribute values as the user would like to refine and may be executed either before or after the search is conducted. Value resource parameter data elements associated with context attribute values for different domains, are provided in FIG. 3 as samples of data which may be represented in this Value-Resource Parameter Workspace **235**.

Regarding FIG. 5, with more particularity, the Resource Selection Criteria Workspace **238** includes a list of criteria **245** which may be used in evaluating resources. This list, provided by the system, is customized by domain; but in all domains, it involves criteria including, but not limited to issues such as: cost, time, timing, quality and risk associated with using a particular resource to satisfy the user's specific need. The initial system default might be to use all criteria and weight them equally. Over time, however, the default criteria may be set by the system based upon user context, user prior transaction history and user behavior on prior searches. If the user wishes to further reduce the set of criteria, they may do so by assigning a weight, for example a percentage weight, to each criteria they want used in the entry boxes **242**. Along with each of the criteria selected there exists a range of acceptable values specified on an associated individual slider element **250**. The initial system default, may be "unlimited" and then, may be set over time based upon user context, use and behavior. Additionally, the user may use drag and drop tabs **252a,b** on the slider element **250** to set a minimum and/or maximum value for the associated resource selection criteria. It is understood that the unit of measure on the sliders may vary by criteria. Further, via entry boxes **241**, the user may select to view via "check" or specify via number entry the display sequence of these criteria when arrayed as the axes on an n-dimensional graphic display provided in the Results Display Workspace via graphic interface **32** as described in commonly owned, co-pending U.S. patent application Ser. No. 09/778,147, or when viewed on another visualization system.

The Detailed Specification Workspace **23** thus provides full disclosure of system defaults and enables the user to completely manage their search.

With respect to the third step, a display of the annotated response set is provided in a form ready for preview or selection as described herein with respect to FIG. 7. The user



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may rework this screen as many times as needed to better understand and make decisions about resource(s) to use. More particularly, via the Results Display Workspace **33** the user may: 1) view the response set, ranked by the aggregate value and weighting as defined by resource selection criteria and value ranges; 2) select one or many of the ranked responses for graphical display in multi-dimensions along the multiple axes of the resource selection criteria; and, 3) initiate a “roll over” of one or more resources from either the ranked list or the graphical display to view detailed descriptions or to “preview” the resource. If there are too many responses, too few, or if they are incorrect, the user may return to the second step to further refine/redefine, and re-execute the lookup. Alternately, the user may return to the first step to choose a different context for their search.

While the system is intended to operate on a fully enabled graphic workstation or personal computer, it is intended that search definition and the results visualization processes described herein with respect to FIGS. **4**, **5** and **7** may be operated by users of reduced graphics-enabled devices such as text screen workstations, Organizers, or any type of Personal Digital Assistants (PDAs). Accordingly, in alternative embodiments, all the context icons may have names, all the graphical displays may be reduced to lists, all the pull downs may be viewed as indented lists or secondary screens, and all the min-max sliders may convert to fill-in boxes. Further, as mentioned, the customer self service system described herein is applicable to many applications including the domains of education, real estate, and travel. The generic process flow described with respect to FIG. **2**, will now be described with specific examples from the education, real estate and travel domains as shown in FIG. **3**.

With respect to the education domain, the user is a learner and FIG. **3** depicts an example interaction with the system through the iconic interfaces (FIG. **2**) included in the embodiment of the invention as applied to the education domain. The three iconic workspaces of FIG. **2** enable the learner to specify example data elements, such as the example data elements depicted in the Education (e.g., Environmental) column **60** of FIG. **3**, and view results, as follows: In the first process step, the learner uses the Context Selection Workspace (interface **12** of FIG. **4**) to specify their query **61** as “Learn Lotus Notes at home.” The learner may select the User Context “Remote Staffie”, for example (where the icon’s name is highlighted in FIG. **3**), from among the available set of context icons **62**. The learner may then elect to go to the Detail Specification Workspace (interface **22** of FIG. **5**) in the second process step in order to view the context attributes **63** associated with the “Remote Staffie” User Context. Preferably, the default assigned context attribute value (“DSL”, for example) for any context attribute (“Connectivity”, for example) is visible on the context attribute icon (“Connectivity”, for example, whose name is shown highlighted in FIG. **3**). The learner may click on the context attribute “Connectivity” to see the menu of associated attribute values **64**. The learner, for example, may select the “Disconnected” attribute value shown highlighted in FIG. **3**. By double clicking on this attribute value the list of Value Resource Parameters, i.e., include/exclude filters **65**, for the attribute value “Disconnected” is displayed. The learner, for example, may indicate that they want to include download and play resources and exclude online collaborative resources when searching for relevant resources. The learner may additionally specify resource priorities **66** by selecting, sequencing and weighting and specifying minimum and maximum values for

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relevant criteria such as cost, time, quality and risk on the Resource Selection Criteria Definition graphical user interface element on the Detail Specification Workspace (interface **22** of FIG. **5**). In the third step of the process, the results of the learner’s search are listed in the user view of the Results Display Workspace (interface **32** of FIG. **2**). The learner may immediately select one or more of the listed education resources, request to see additional details on them, or request to see a response set graphic indicating the relative positioning of each resource along each of the axes (n-dimensions, relating to cost, time, quality and risk) specified earlier. If no acceptable education resources were provided, the learner may return to the Context Selection Workspace to redefine their query or select a different User Context such as “Commuting Techie” via the first interface. The learner may additionally elect to return to the Detail Specification Workspace of the second interface to change the default value of the context attribute “Connectivity” from Disconnected to Dial-up and add or remove Value Resource Parameters for the attribute value Dial-up or other context attribute values associated with context attributes such as “Learning Mode” or “Technical Field”. The learner may also change their selection criteria, the weighting of the selection criteria, and the minimum/maximum values for any selection criteria, in hopes of identifying additional relevant resources.

With respect to the education domain, the user is a “learner” however, the three iconic workspaces of FIG. **2** provide the process for enabling the learner to specify example data elements, such as the example data elements depicted in the Education (e.g., Subject Matter) column **70** of FIG. **3**, and view results, as follows: In the first process step, the learner uses the Context Selection Workspace (interface **12** of FIG. **4**) to specify their query **71** as “Become a Linux developer by June” for example. The learner selects the User Context “Commuting Techie” from among the available context icons **72**. The learner may elect to go to the Detail Specification Workspace in order to view the context attributes **73** associated with the “Commuting Techie” user context. Preferably, the default assigned context attribute value (“Programming”, for example) for any context attribute (“Technical Field”, for example) is visible on the context attribute icon (“Technical Field”, for example, whose name is shown highlighted in FIG. **3**). In addition, the learner may click on the context attribute (“Technical Field, to stay with the example) to display a pull down menu to view the other values **74** (in either picture or word format) that could be assigned to this attribute. The learner, for example, may select “Graphical Interfaces” shown highlighted in FIG. **3**. By double clicking on this attribute value, the list of Value Resource Parameters (include/exclude filters **75**) for the attribute value “Graphical Interfaces” will be displayed. For example, the learner may indicate that they want to include the KDE interface and exclude the GNOME interface when searching for relevant resources. The learner may additionally specify resource priorities **76** by selecting, sequencing and weighting and specifying minimum and maximum values for relevant criteria such as cost, time, quality and risk on the Resource Selection Criteria Definition graphical user interface element on the Detail Specification Workspace. The results of the learner’s search are listed on the Results Display Workspace via the interface **32**. The learner may immediately select one or more of the listed education resources, request to see additional details on them, or request to see a response set graphic indicating the relative positioning of each resource along each of the axes (n-dimensions, relating to cost, time, quality and risk) speci-

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fied earlier. If no acceptable education resources were provided, the learner may return to the Context Selection Workspace 13 via the first interface 12 to redefine their query or select a different user context such as "Traveling Consultant." The learner may also elect to return to the Detail Specification Workspace via the second interface 22 to change the default value of the context attribute "Technical Field" from Graphical Interfaces to Programming and add or remove Value Resource Parameters for the attribute value Programming or other context attribute values associated with context attributes such as "Learning Mode" or "Connectivity." The learner may also change their selection criteria, the weighting of the selection criteria, and the minimum/maximum values for any selection criteria, in hopes of identifying additional relevant resources.

With respect to the real-estate domain, the user is a real estate transactor (renter/buyer) and FIG. 3 depicts an example interaction with the system through the iconic interfaces (FIG. 2) included in the embodiment of the invention as applied to the real estate domain. The three iconic workspaces of FIG. 2 enable a real estate renter or buyer to specify example data elements, such as the example data elements depicted in the Real Estate column 80 of FIG. 3, and view results, as follows: In the first process step, the renter or buyer uses the Context Selection Workspace to specify their query 81 as "Find housing near new job by August." The renter or buyer selects the user context "Relocating Business Professional" from among the available context icons 82. The renter or buyer may elect to go to the Detail Specification Workspace in the second interface in order to view the context attributes 83 associated with the "Relocating Business Professional" user context. Preferably, the default assigned context attribute value ("Subcontract it all", for example) for any context attribute ("Maintenance Style", for example) is visible on the context attribute icon ("Maintenance Style", for example, whose name is shown highlighted in FIG. 3). In addition, the renter/buyer may click on the context attribute ("maintenance style, to stay with the example) to display a pull down menu to view the other values 84 (in either picture or word format) that could be assigned to this attribute. Upon renter or buyer double clicking on attribute value "Do-It-YourSelf-er", for example, the list of Value Resource Parameters (include/exclude filters 85) for the attribute value "Do-It-YourSelf-er" is displayed. For example, as shown in FIG. 3, the renter or buyer may indicate that they want to include walls, paint and lawn mowing and exclude plumbing, electrical and landscaping when searching for relevant resources. The renter or buyer may additionally specify resource priorities 86 by selecting, sequencing and weighting and specifying minimum and maximum values for relevant criteria such as cost, time, quality and risk on the Resource Selection Criteria Definition graphical user interface element on the Detail Specification Workspace. The results of the renter or buyer's search are listed on the Results Display Workspace of the third interface 32 in which the renter or buyer may immediately select one or more of the listed real estate resources, request to see additional details on them, or request to see a response set graphic indicating the relative positioning of each resource along each of the axes (n-dimensions, relating to cost, time, quality and risk) specified earlier. If no acceptable housing resources were provided, the renter or buyer may return to the Context Selection Workspace to redefine their query or select a different user context such as "Empty Nester." The renter or buyer can also elect to return to the Detail Specification Workspace to change the default value of the context

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attribute "Maintenance Style" from Do-It-Yourself-er to Subcontract It All, for example, and add or remove Value Resource Parameters for the attribute value "Subcontract It All" or other context attribute values associated with context attributes such as "Mode of Commute to Work/School" or "Mode of Housing." The real estate transactor may also change their selection criteria, the weighting of the selection criteria, and the minimum/maximum values for any selection criteria, in hopes of identifying additional relevant resources.

With respect to the travel domain, the user is a traveler and FIG. 3 depicts an example interaction with the customer self service system through the iconic interfaces (FIG. 2) included in the embodiment of the invention as applied to the travel domain. The three iconic workspaces of FIG. 2 enable a traveler to specify data elements, such as the example data elements depicted in the Travel column 90 of FIG. 3, and view results, as follows: In the first process step, the traveler uses the Context Selection Workspace to specify their query 91 such as "Plan a trip to Vermont in June", for example. The traveler may then select the User Context Icon "Single Mom with kids", for example, from among the available user context icons 132, (where the icon's name 92 is highlighted in FIG. 3). The traveler may then elect to go to the Detail Specification Workspace in order to view the context attributes 93 associated with the "Single Mom with Kids" user context.

Preferably, the default assigned context attribute value ("Drive", for example) for any context attribute ("Mode of Transportation", for example) is visible on the context attribute icon ("Mode of Transportation", for example, whose name is shown highlighted in FIG. 3). In addition, the traveler may click on the context attribute ("mode of transportation", to stay with the example) to display a pull down menu to view the other values 94 (in either picture or word format) that could be assigned to this attribute ("Fly" for example). The traveler selects "fly" as an alternative to "drive", as illustrated with highlighting in FIG. 3. By "overriding" this attribute value and double clicking on it, the list of Value Resource parameters (include/exclude filters 95) for the attribute value "Fly" is displayed. The traveler may indicate that he/she wants to include all major carriers and exclude prop planes and airlines with bad safety records when searching for relevant resources. The traveler may also specify resource priorities 96 by selecting, sequencing and weighting and specifying minimum and maximum values for relevant criteria such as cost, time, quality and risk on the Resource Selection Criteria Definition graphical user interface element on the Detail Specification Workspace. The results of the traveler's search are then displayed via the Results Display Workspace of the third iconic interface 32 of FIG. 2. The traveler may immediately select one or more of the listed travel resources, request to see additional details on them, or request to see a response set graphic indicating the relative positioning of each resource along each of the axes (n-dimensions, relating to cost, time, quality and risk) specified earlier. If no acceptable travel resources were provided, the traveler may return to the Context Selection Workspace in Step 1 to redefine their query or select a different user context such as "Swinging Singles." The traveler may also elect to return to the Detail Specification Workspace in Step 2 to change the default value of the context attribute "Mode of Transportation" from Fly to Train and add or remove Value Resource Parameters for the attribute value Train or other context attribute values associated with context attributes such as "Mode of Housing" or "Food Style". The traveler may also change their selection

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criteria, the weighting of the selection criteria, and the minimum/maximum values for any selection criteria, in hopes of identifying additional relevant resources.

Referring back to FIG. 1, the customer self service system implements an n-dimensional context vector 25', derived from the combination of user context and previous interaction with the system, to map specific contexts to specific resources. This increases the relevance of search results for a given user in their current context without requiring the user to explicitly train the system. Inferences and conclusions are made regarding both the individual user's preferred resource characteristics and those of a common set of users. These are used as input to the sub-processes of the invention described herein and in sub-systems described in above-mentioned commonly-owned, co-pending U.S. patent application Ser. Nos. 09/778,378, 09/778,135 and, to modify the ionic interfaces presented to each particular user for their subsequent search using the current invention as well as to modify the results that would be selected for presentation to the user via the interface described in Ser. No. 09/778,147 in response to an identical search. Over time, the system will improve in its ability to serve individual needs and evolve to an ability to suggest preferred answers to groups of users.

The overall system also uses a batch background process described in commonly-owned, co-pending U.S. patent application Ser. No. 09/778,149 to cluster user interaction records to assist in the identification of new user contexts which serves to improve the system over time.

While the prior art has made use of adaptive learning in information retrieval systems, the overall customer self service system for resource search and selection enables the use of a large, rich set of contextual attribute-value pairs, is focused on learning about the user/user groups rather than the resources/resource groups and is able to discover user group characteristics and apply them to individuals. Much of the prior art is focused on the discovery of database structure, the clustering of data within the resources, or discovering relevant taxonomy for resources but the current system discovers contexts and context attributes among users which can be used predictively. The customer self-service system of the invention uses a highly specialized and optimized combination of supervised & unsupervised logic along with both automated and semi-automated entry of learned results and is able to deliver higher value because contexts are used in a closed loop self improvement system; front end (entry) middle (search and display) and back end (results and user feedback) are integrated. Other systems apply machine learning at the front, middle, or back, but not integrated throughout. The current system identifies context classifications and functions, and applies them to individual users to reduce the burden of fully communicating their question and increasing the specificity and accuracy of a query's search parameters. The current system identifies and improves selection logic and identifies and improves response sets to common queries based upon a rich set of contextual variables. The current system additionally orders the response set, potentially further limiting it, and prepares the response set for display in a way that identifies the "best" resources for a particular user based upon the rich set of context variables. The display of the invention additionally illustrates the decision making characteristics of the alternatives presented.

While the invention has been particularly shown and described with respect to illustrative and preformed embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and

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scope of the invention which should be limited only by the scope of the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent is:

1. A resource results annotator for a customer self service system that performs resource search and selection comprising:

mechanism for receiving a resource response set of results obtained in response to a current user query;

mechanism for receiving a user context vector associated with said current user query, said user context vector comprising data associating an interaction state with said user and including context that is a function of the user; and,

an ordering and annotation function for mapping the user context vector with the resource response set to generate an annotated response set having one or more annotations for controlling the presentation of the resources to the user, wherein the ordering and annotation function is executed interactively at the time of each user query.

2. The resource results annotator as claimed in claim 1, wherein said annotations include elements for ordering resource results to be displayed via a graphical user interface.

3. The resource results annotator as claimed in claim 1, wherein said annotations include elements for bolding one or more resource results to be displayed via a graphical user interface.

4. The resource results annotator as claimed in claim 1, wherein said annotations include elements for determining one or more primary resource results to be displayed on a first display screen via a graphical user interface and which are secondary resource results for presentation via a secondary display screen.

5. The resource results annotator as claimed in claim 1, wherein said self service system includes a database of user interaction records including actual resources selected by the users and the annotation schemes used for presenting them via a graphical interface, said annotator further comprising a processing mechanism for receiving user interaction data from among said database of user interaction records and an annotation scoring metric representing a measure of performance in locating resource response results displayed via said graphical interface, and, generating said ordering and annotation function, said annotation function being adaptable based on history of user interactions as provided in said database of user interaction records.

6. The resource results annotator as claimed in claim 1, wherein said processing mechanism for generating said ordering and annotation function is performed off-line.

7. The resource results annotator as claimed in claim 5, wherein said user interaction data comprises past and present user queries.

8. The resource results annotator as claimed in claim 5, wherein said user interaction data comprises system responses to said user queries.

9. The resource results annotator as claimed in claim 5, wherein said user interaction data comprises raw context information including: one or more of static, historical context, transient context, organizational context, community context, and environment context.

10. The resource results annotator as claimed in claim 9, wherein said user interaction data comprises other raw context associated with the user and dependent upon that user's interaction state and query domain.

11. The resource results annotator as claimed in claim 10, wherein a query domain includes one of: education, travel and real estate.



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12. The resource results annotator as claimed in claim 5, wherein said processing mechanism implements a supervised learning algorithm.

13. The resource results annotator as claimed in claim 12, wherein said user interaction data comprises user interaction feedback, said supervised learning algorithm optimizing said annotation scoring metric as measured by said user interaction feedback.

14. A method for annotating resource results obtained in a customer self service system that performs resource search and selection, said method comprising the steps of:

- a) receiving a resource response set of results obtained in response to a current user query;
- b) receiving a user context vector associated with said current user query, said user context vector comprising data associating an interaction state with said user and including context that is a function of the user;
- c) applying an ordering and annotation function for mapping the user context vector with the resource response set to generate an annotated response set having one or more annotations; and,
- d) controlling the presentation of the resource response set to the user according to said annotations, wherein the ordering and annotation function is executed interactively at the time of each user query.

15. The method as claimed in claim 14, wherein said controlling step d) further includes the step of bolding one or more resource results to be displayed via a graphical user interface.

16. The method as claimed in claim 14, wherein said controlling step d) further includes the step of determining one or more primary resource results to be displayed on a first display screen via a graphical user interface and which are secondary resource results for presentation via a secondary display screen.

17. The method as claimed in claim 14, wherein said self service system includes a database of user interaction records including actual resources selected by the users and the annotation schemes used for presenting them via a graphical interface, said method further comprising the steps of:

- receiving user interaction data from among said database of user interaction records and an annotation scoring metric representing a measure of performance in locating resource response results displayed via said graphical interface; and,
- generating said ordering and annotation function, said annotation function being adaptable based on history of user interactions as provided in said database of user interaction records.

18. The method as claimed in claim 17, wherein said step of generating said ordering and annotation function is performed off-line.

19. The method as claimed in claim 17, further including implementing a supervised learning algorithm for generating said ordering and annotation function.

20. The method as claimed in claim 18, wherein said user interaction data comprises user interaction feedback, said supervised learning algorithm optimizing said annotation scoring metric as measured by said user interaction feedback.

21. A program storage device readable by machine, tangibly embodying a program of instructions executable by the

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machine to perform method steps for annotating resource results obtained in a customer self service system that performs resource search and selection, said method comprising the steps of:

- a) receiving a resource response set of results obtained in response to a current user query;
- b) receiving a user context vector associated with said current user query, said user context vector comprising data associating an interaction state with said user and including context that is a function of the user;
- c) applying an ordering and annotation function for mapping the user context vector with the resource response set to generate an annotated response set having one or more annotations; and,
- d) controlling the presentation of the resource response set to the user according to said annotations, wherein the ordering and annotation function is executed interactively at the time of each user query.

22. The program storage device readable by machine as claimed in claim 21, wherein said controlling step d) further includes the step of ordering resource results to be displayed via a graphical user interface.

23. The program storage device readable by machine as claimed in claim 21, wherein said controlling step d) further includes the step of bolding one or more resource results to be displayed via a graphical user interface.

24. The program storage device readable by machine as claimed in claim 21, wherein said controlling step d) further includes the step of determining one or more primary resource results to be displayed on a first display screen via a graphical user interface and which are secondary resource results for presentation via a secondary display screen.

25. The program storage device readable by machine as claimed in claim 21, wherein said self service system includes a database of user interaction records including actual resources selected by the users and the annotation schemes used for presenting them via a graphical interface, said method further comprising the steps of:

- receiving user interaction data from among said database of user interaction records and an annotation scoring metric representing a measure of performance in locating resource response results displayed via said graphical interface; and,
- generating said ordering and annotation function, said annotation function being adaptable based on history of user interactions as provided in said database of user interaction records.

26. The program storage device readable by machine as claimed in claim 21, wherein said step of generating said ordering and annotation function is performed off-line.

27. The program storage device readable by machine as claimed in claim 25, further including implementing a supervised learning algorithm for generating said ordering and annotation function.

28. The method as claimed in claim 26, wherein said user interaction data comprises user interaction feedback, said supervised learning algorithm optimizing said annotation scoring metric as measured by said user interaction feedback.

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# **EXHIBIT 5**



**DESMARAIS** LLP

# **Zillow Infringes U.S. Patent No. 6,785,676 (Oblinger)**

*Subject to Fed. R. Evid. 408*

# U.S. Patent No. 6,785,676 (Oblinger) – Overview

(12) <b>United States Patent Oblinger</b>	(10) <b>Patent No.: US 6,785,676 B2</b> (45) <b>Date of Patent: Aug. 31, 2004</b>
(54) <b>CUSTOMER SELF SERVICE SUBSYSTEM FOR RESPONSE SET ORDERING AND ANNOTATION</b>	OTHER PUBLICATIONS  “The Answer Machine” (Information Services Manage- ment) (Industry Trend or Event), by Susan Feldman, Jan. 2000, The Magazine for Database Professionals, 41 pages.
(75) Inventor: <b>Daniel A. Oblinger</b> , New York, NY (US)	(List continued on next page.)
(73) Assignee: <b>International Business Machines Corporation</b> , Armonk, NY (US)	<i>Primary Examiner</i> —Alford Kindred (74) <i>Attorney, Agent, or Firm</i> —Scully, Scott, Murphy & Presser; Daniel P. Morris, Esq.
( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 310 days.	(57) <b>ABSTRACT</b>  A system and method for annotating resource results obtained in a customer self service system that performs resource search and selection. The method comprising the steps of: receiving a resource response set of results obtained in response to a current user query and receiving a user context vector associated with the current user query, the user context vector comprising data associating an interac- tion state with the user; applying an ordering and annotation function for mapping the user context vector with the resource response set to generate an annotated response set having one or more annotations; and, controlling the pre- sentation of the resource response set to the user according to the annotations, wherein the ordering and annotation
(21) Appl. No.: <b>09/778,139</b>	
(22) Filed: <b>Feb. 7, 2001</b>	
(65) <b>Prior Publication Data</b>	
US 2002/0105532 A1 Aug. 8, 2002	
(51) <b>Int. Cl.</b> <sup>7</sup> ..... <b>G06F 17/30; G06F 17/00</b>	
(52) <b>U.S. Cl.</b> ..... <b>707/5; 707/4; 715/512</b>	
(58) <b>Field of Search</b> ..... 707/1–8, 101–102, 707/104.1; 345/700–702, 748, 744, 707–708; 715/512	

# U.S. Patent No. 6,785,676 (Oblinger) – Claim 14

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**14. A method for annotating resource results obtained in a customer self service system that performs resource search and selection, said method comprising the steps of:**

- a) receiving a resource response set of results obtained in response to a current user query;**
- b) receiving a user context vector associated with said current user query, said user context vector comprising data associating an interaction state with said user and including context that is a function of the user;**
- c) applying an ordering and annotation function for mapping the user context vector with the resource response set to generate an annotated response set having one or more annotations; and,**
- d) controlling the presentation of the resource response set to the user according to said annotations, wherein the ordering and annotation function is executed interactively at the time of each user query.**

# U.S. Patent No. 6,785,676 (Oblinger) – Claim 14

**14. A method for annotating resource results obtained in a customer self service system that performs resource search and selection, said method comprising the steps of:**

Recommendation systems often rely on engagement from users as a source of data for learning high-quality recommendations. However, in contrast to websites such as Amazon, Netflix and Airbnb, a large number of users visiting Zillow are new users or users who do not have a registered account. These new users could be first-time home buyers, new renters, home shoppers new to online marketplaces, travelers curious about the local housing market, or people who use Zillow to obtain real estate information. For these users, the similar home carousel on each home details page (such as the one shown on the right side of Figure 1) plays an important role in surfacing interesting content and improving their experience. As users express their interest by clicking on one home, the similar home carousel enables users to directly explore related listings on Zillow, without having to return to the search page or select filters.

<https://www.zillow.com/data-science/embedding-similar-home-recommendation/>



# U.S. Patent No. 6,785,676 (Oblinger) – Claim 14

receiving a resource response set of results obtained in response to a current user query;

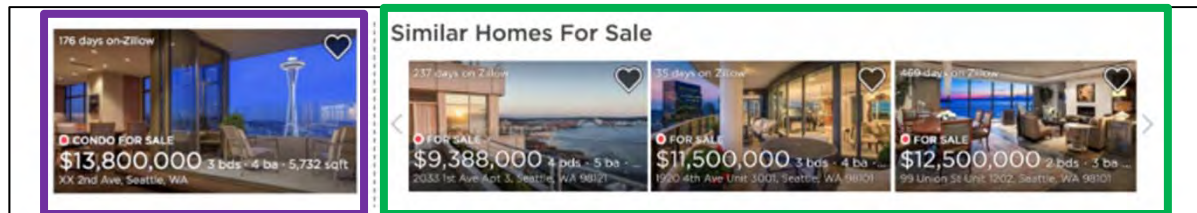


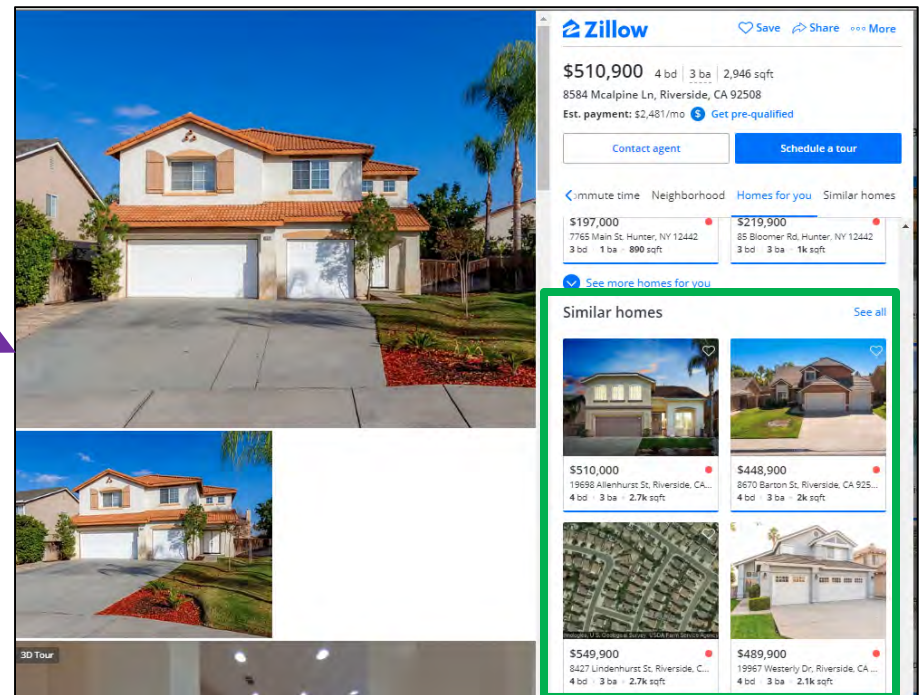
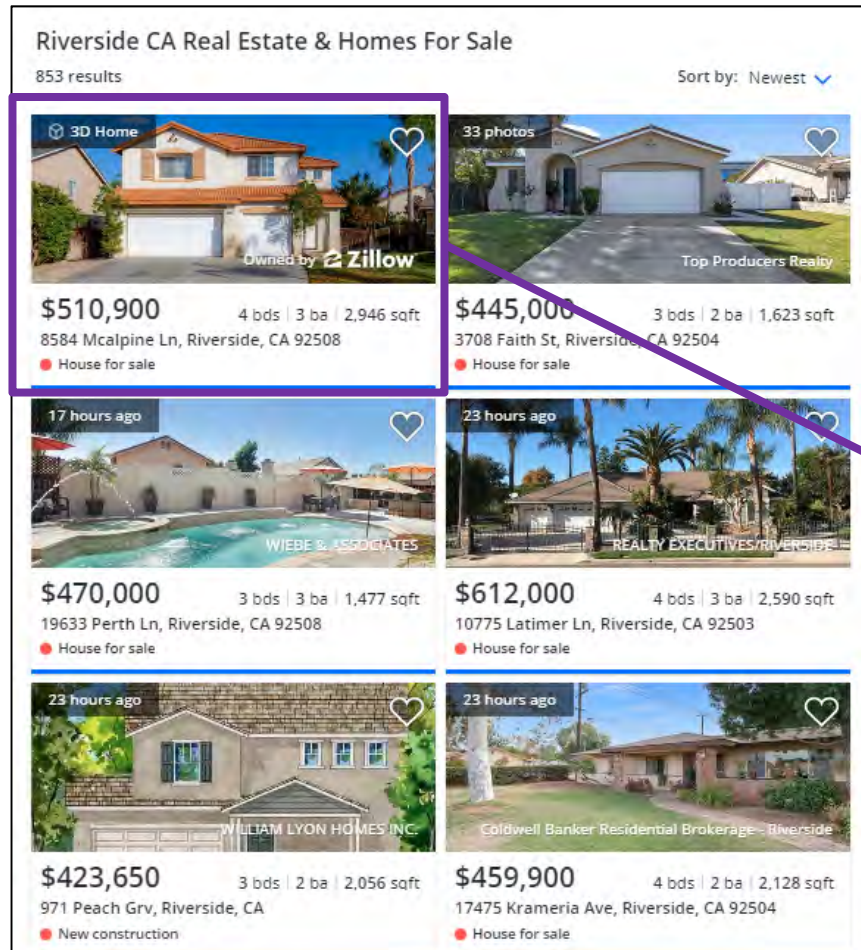
Figure 1: Similar home recommendations on Zillow

Recommendation systems often rely on engagement from users as a source of data for learning high-quality recommendations. However, in contrast to websites such as Amazon, Netflix and Airbnb, a large number of users visiting Zillow are new users or users who do not have a registered account. These new users could be first-time home buyers, new renters, home shoppers new to online marketplaces, travelers curious about the local housing market, or people who use Zillow to obtain real estate information. For these users, the similar home carousel on each home details page (such as the one shown on the right side of Figure 1) plays an important role in surfacing interesting content and improving their experience. As users express their interest by clicking on one home, the similar home carousel enables users to directly explore related listings on Zillow, without having to return to the search page or select filters.

<https://www.zillow.com/data-science/embedding-similar-home-recommendation/>

# U.S. Patent No. 6,785,676 (Oblinger) – Claim 14

receiving a resource response set of results obtained in response to a current user query;



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receiving a user context vector associated with said current user query, said user context vector comprising data associating an interaction state with said user and including context that is a function of the user;

Due to the lack of explicit ratings for individual homes from our customer, we have to rely on implicit feedback, e.g., how long customers spend on the details page of each home they visited. To process this data we use the method of Implicit Matrix Factorization (IMF) for collaborative filtering [1]. To use the IMF method we build a user-item matrix where each entry represents the implicit feedback or a confidence that particular item is relevant to the user. One important and unique aspect of home recommendations is that our user-item interaction matrix is not only highly sparse but it also consists of several disjoint sub-matrices. This disjointness is due to users interacting with homes primarily in a single region where they are looking to buy a home. For example, a user who searched for homes in Seattle is very unlikely to interact with homes on the East coast in the same home search effort. Hence, due to this locale-specific interest, we apply the IMF method independently in each geographic zone instead of a single nationwide IMF model. As an illustration, the figure below shows a comparison of the user item matrix between traditional e-commerce system and a home-market system.



The goal of the IMF method is to compute a dense vector representations for each user and each item (home) that capture the key elements of a user's preferences and the distinct nature of each home. By computing the dot product of the two latent vectors we can obtain a predicted preference values. These predicted relevance values can then be used to recommend new relevant items to each user. For model training we use the method of Alternating Least Squares (ALS), which updates the user and item vectors in alternating fashion while keeping the other fixed [1].

<https://www.zillow.com/data-science/visualizing-matrix-factorization/>



# U.S. Patent No. 6,785,676 (Oblinger) – Claim 14

applying an ordering and annotation function for mapping the user context vector with the resource response set to generate an annotated response set having one or more annotations; and,

## Similar Home Recommendations with Cold-Start Items

After mapping all the homes to the embedding space, similar home recommendation is reduced to a simple nearest neighbor search based on cosine distance in the embedding space. Our model can readily include any new listings in the recommendations. Whenever a new home is listed, we can look up the precomputed representations for all the categorical attributes to generate the numerical representation for the new listing. Next, the pre-trained neural network maps the numerical representation in the content space to the home embedding space where the cosine similarity can be calculated. The diagram in Figure 9 summarizes the steps to handle new listings.

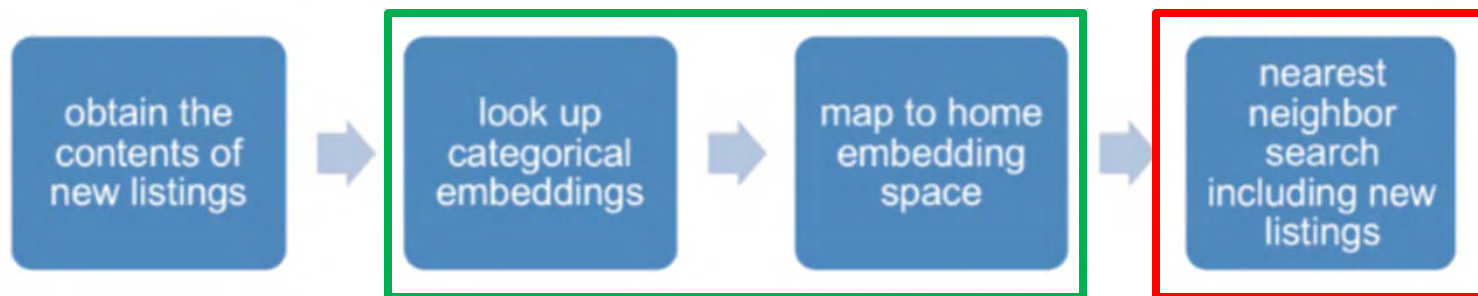


Figure 9: Workflow for similar home recommendations with new listings

<https://www.zillow.com/data-science/embedding-similar-home-recommendation/>

# U.S. Patent No. 6,785,676 (Oblinger) – Claim 14

applying an ordering and annotation function for mapping the user context vector with the resource response set to generate an annotated response set having one or more annotations; and

To construct a Siamese network, the feature representations of a pair of homes, indicated by  $u_i$  and  $u_j$ , are passed through identical sub-networks consisting of several fully connected layers. Each sub-network maps its home into a low-dimensional embedding space (e.g.,  $N=25$ ), as described in Figure 7.

$$e_i = f(u_i) \in R^N, \quad e_j = f(u_j) \in R^N$$

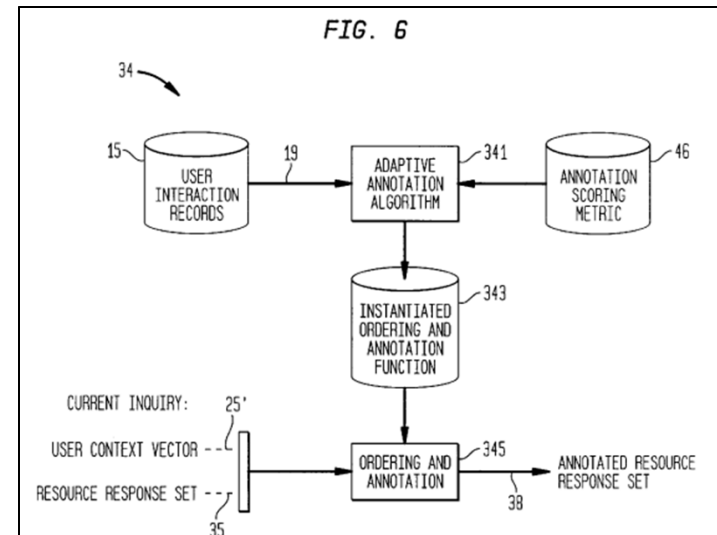
In the new output embedding space, we want the dissimilarity between two homes to be measured by their cosine distance:

$$D_{ij} = 1 - \frac{e_i \cdot e_j}{\|e_i\| \|e_j\|}$$

The parameters of the neural network are optimized so that in this new embedding space, similar homes have smaller cosine distances, and dissimilar homes have larger distances. The supervision for training such networks comes from the co-click or “collaborative” information contained in users’ clickstream data. To construct the training data, we assume that pairs of homes co-clicked by the same user in nearby sessions ( $\leq 10$  minutes) within certain context window (e.g., window size = 3) are relatively more similar and labeled as positives, while homes never co-clicked in this way by any user are less similar and labeled as negatives (as illustrated in Figure 8).



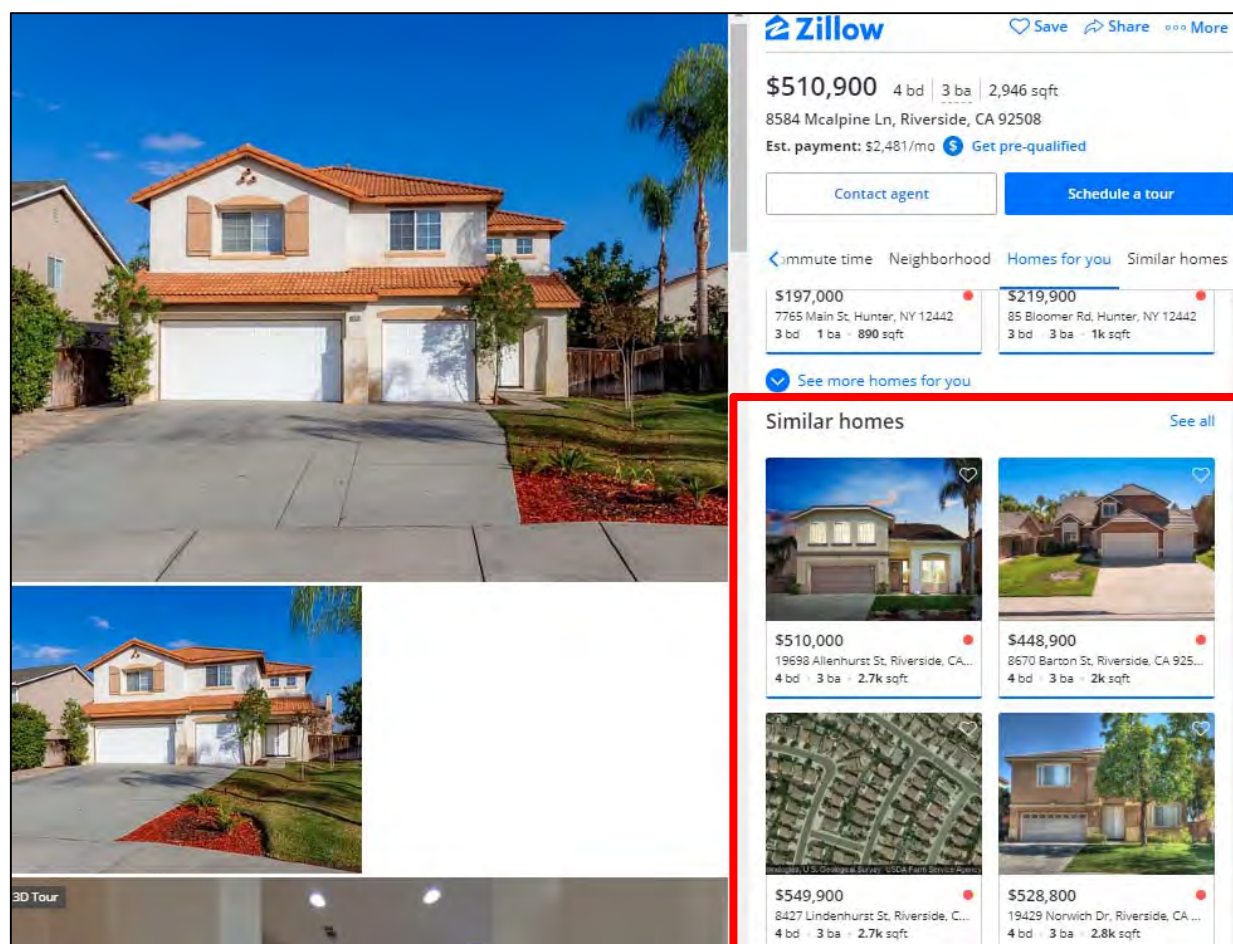
Figure 8: Illustration of extracting positive and negative homes to an anchor home from a user's clickstream data (context window size = 3, nearby session constraint:  $\leq 10$  minutes)



**Ordering and Annotation Function:** “According to the invention, Response Set Ordering and Annotation sub-process 34 receives as input the User Context Vector and Resource Response Set 35 and processes it against data from an Annotation Scoring Metric database 46 and User Interaction Records 19 for the particular user/group. This sub-process 34 weights and ranks the potential responses according to the resource selection criteria specified by the user on the Detailed Specification Workspace described herein, and takes into consideration the scoring metric.” (Oblinger at 6:61-7:3).

# U.S. Patent No. 6,785,676 (Oblinger) – Claim 14

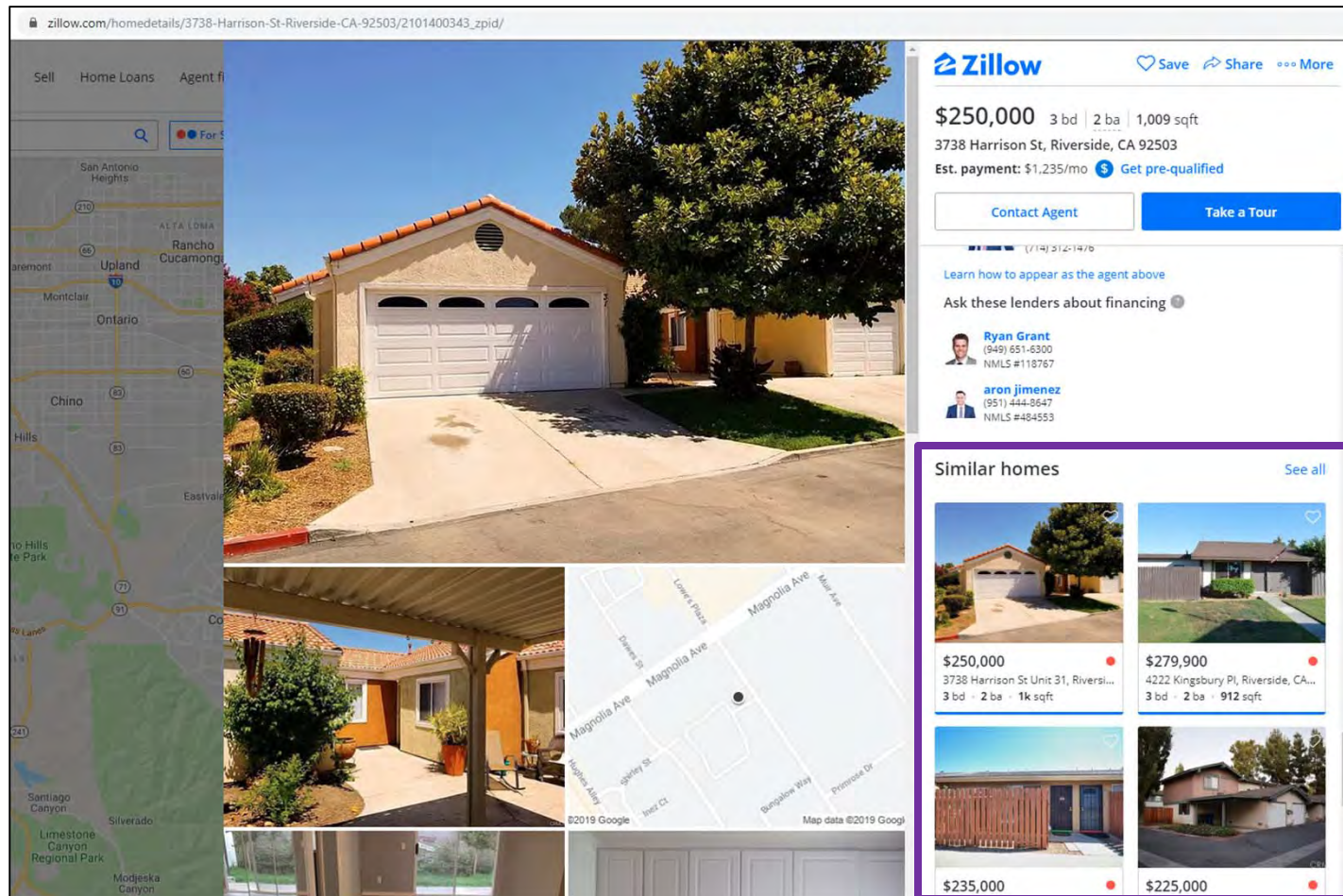
applying an ordering and annotation function for mapping the user context vector with the resource response set **to generate an annotated response set having one or more annotations**; and





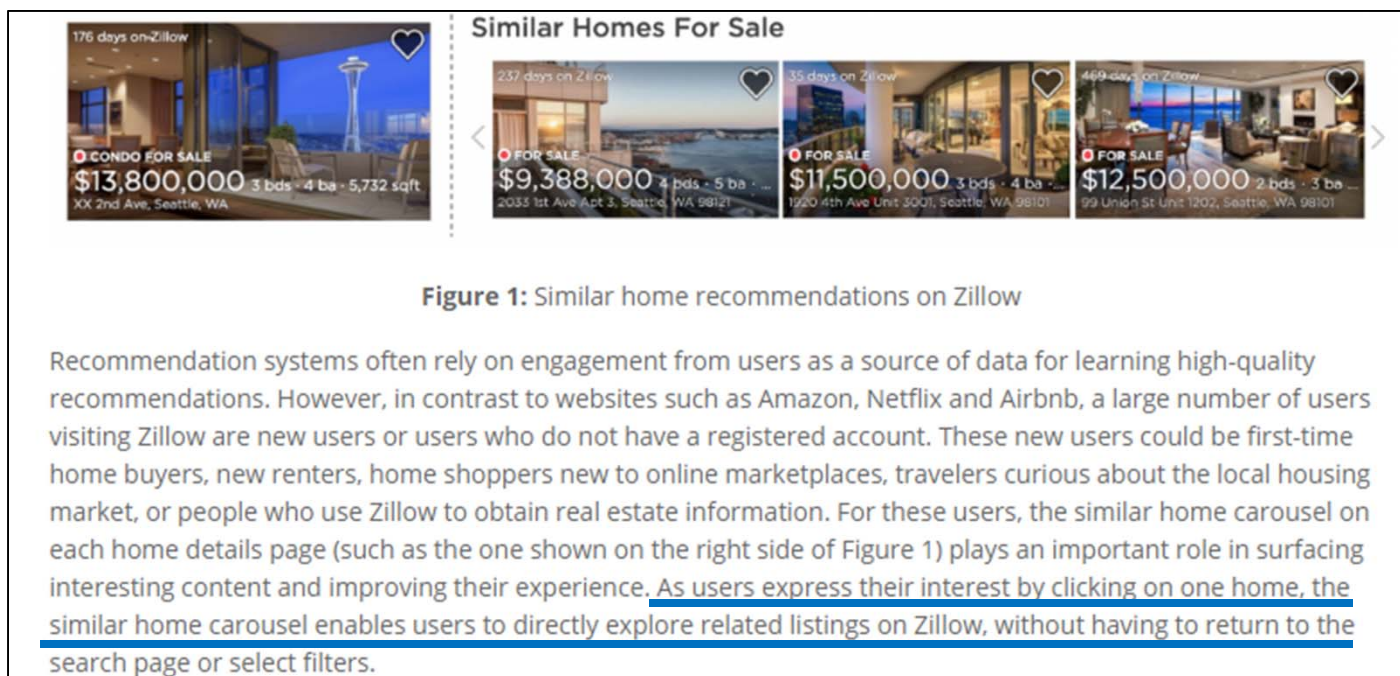
# U.S. Patent No. 6,785,676 (Oblinger) – Claim 14

controlling the presentation of the resource response set to the user according to said annotations, wherein the ordering and annotation function is executed interactively at the time of each user query.



# U.S. Patent No. 6,785,676 (Oblinger) – Claim 14

controlling the presentation of the resource response set to the user according to said annotations, **wherein the ordering and annotation function is executed interactively at the time of each user query.**



<https://www.zillow.com/data-science/embedding-similar-home-recommendation/>

# **EXHIBIT 6**

US007543234B2

(12) **United States Patent**  
**Daniels et al.**(10) **Patent No.:** **US 7,543,234 B2**  
(45) **Date of Patent:** **Jun. 2, 2009**(54) **STACKING PORTLETS IN PORTAL PAGES**2002/0038228 A1 3/2002 Waldorf et al. .... 705/7  
2002/0046257 A1 4/2002 Killmer ..... 709/218  
2002/0167538 A1 11/2002 Bhetanabhotla ..... 345/700(75) Inventors: **Fonda J. Daniels**, Cary, NC (US); **David Bruce Kumhyr**, Austin, TX (US); **Paul Franklin McMahan**, Apex, NC (US)

(Continued)

(73) Assignee: **International Business Machines Corporation**, Armonk, NY (US)

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( \* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 320 days.

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US 2007/0006083 A1 Jan. 4, 2007

(51) **Int. Cl.**  
**G06F 3/00** (2006.01)(52) **U.S. Cl.** ..... **715/742**; 715/790; 715/766;  
715/767(58) **Field of Classification Search** ..... 715/790,  
715/742, 513, 766, 767, 802  
See application file for complete search history.(56) **References Cited**

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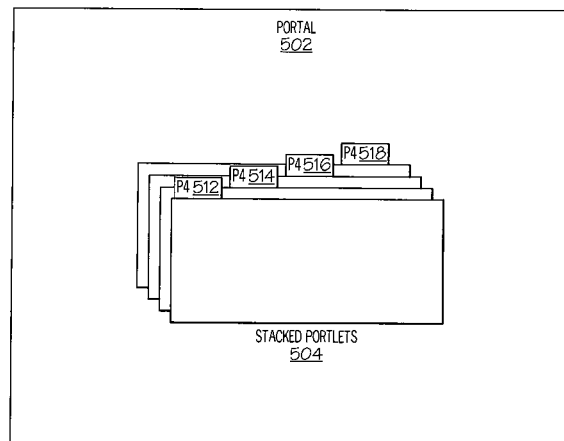
(Continued)

*Primary Examiner*—Stephen S Hong*Assistant Examiner*—Omar Abdul-Ali(74) *Attorney, Agent, or Firm*—Yee & Associates, P.C.;  
Robert E. Straight, II(57) **ABSTRACT**

A portal is comprised of a plurality of portlets. Each portlet accesses hardware and software to gather data. Each portlet offers information to the portal page. Each portlet's information has a specific content type and markup. A subset of portlets are determined stackable if the subset of portlets have in common one or more of the same hardware, software, content type or markup. Once a subset of portlets is determined stackable, the user's preference for stacking the portlets is obtained by loading a user profile or asking the user. If the subset of portlets are stackable and the user desires the subset of portlets stacked, then the subset of portlets are stacked such that the stack of portlets present a first portlet and a control for selecting a second portlet from within the subset of portlets that is not currently presented.

**18 Claims, 6 Drawing Sheets**

500 ↗



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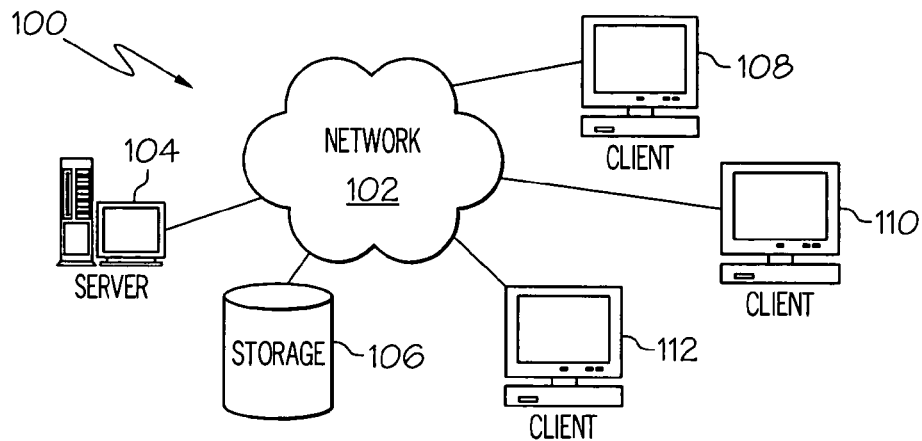


FIG. 1

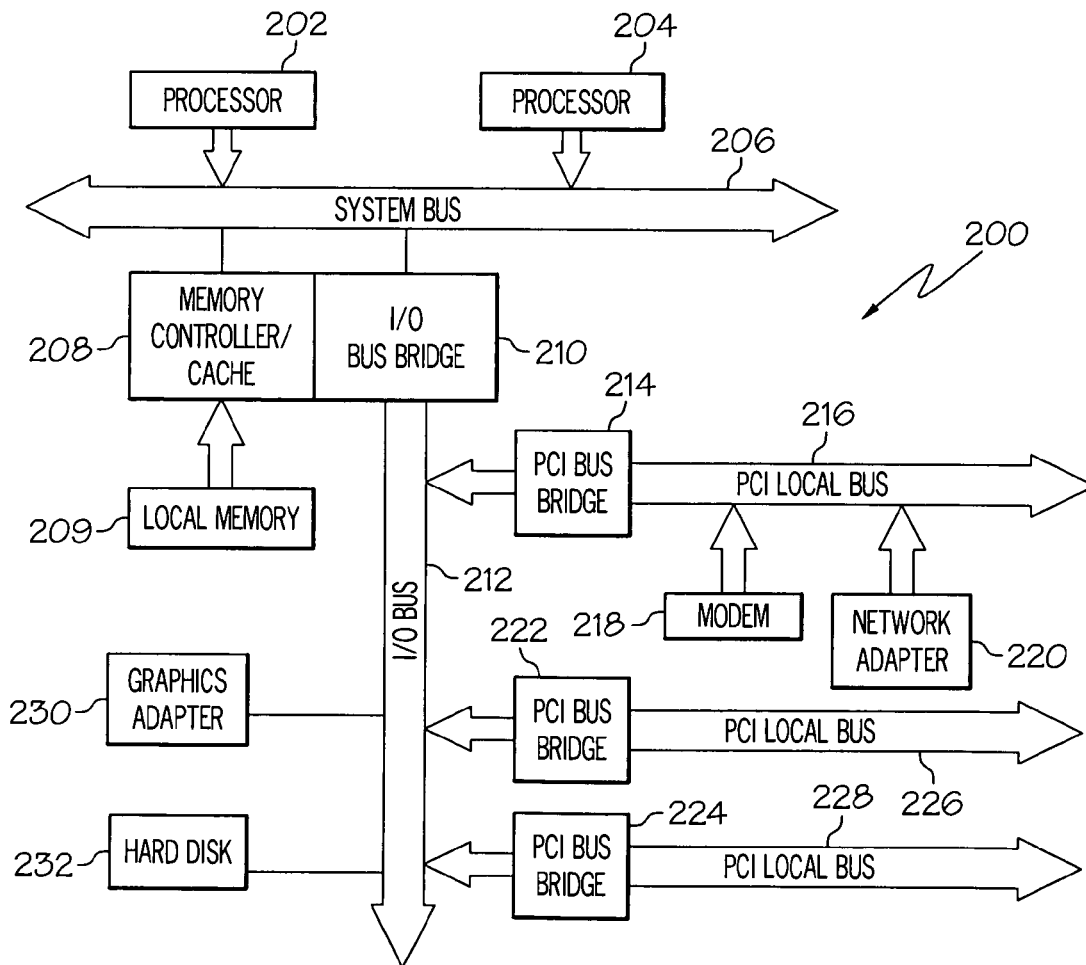


FIG. 2



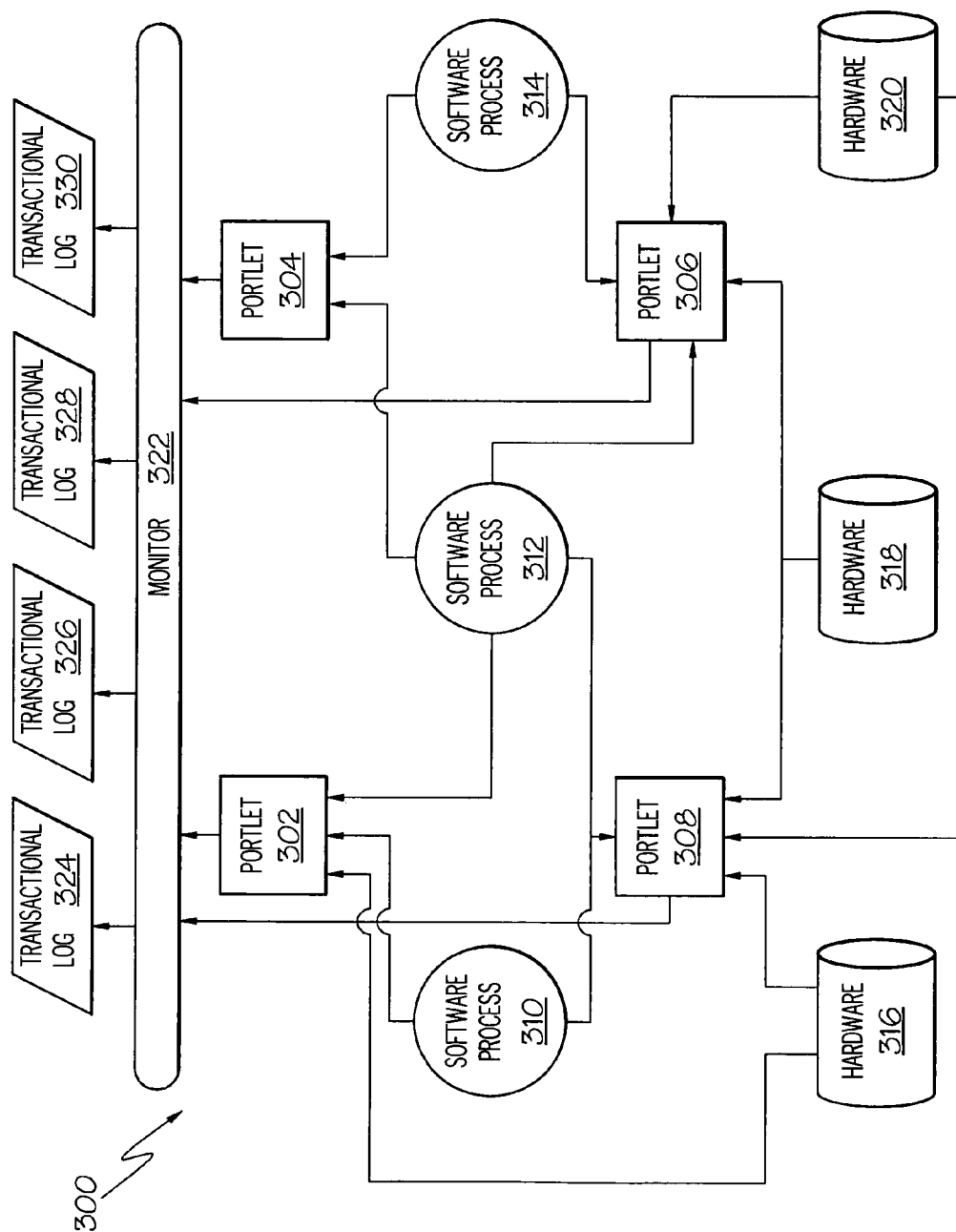


FIG. 3

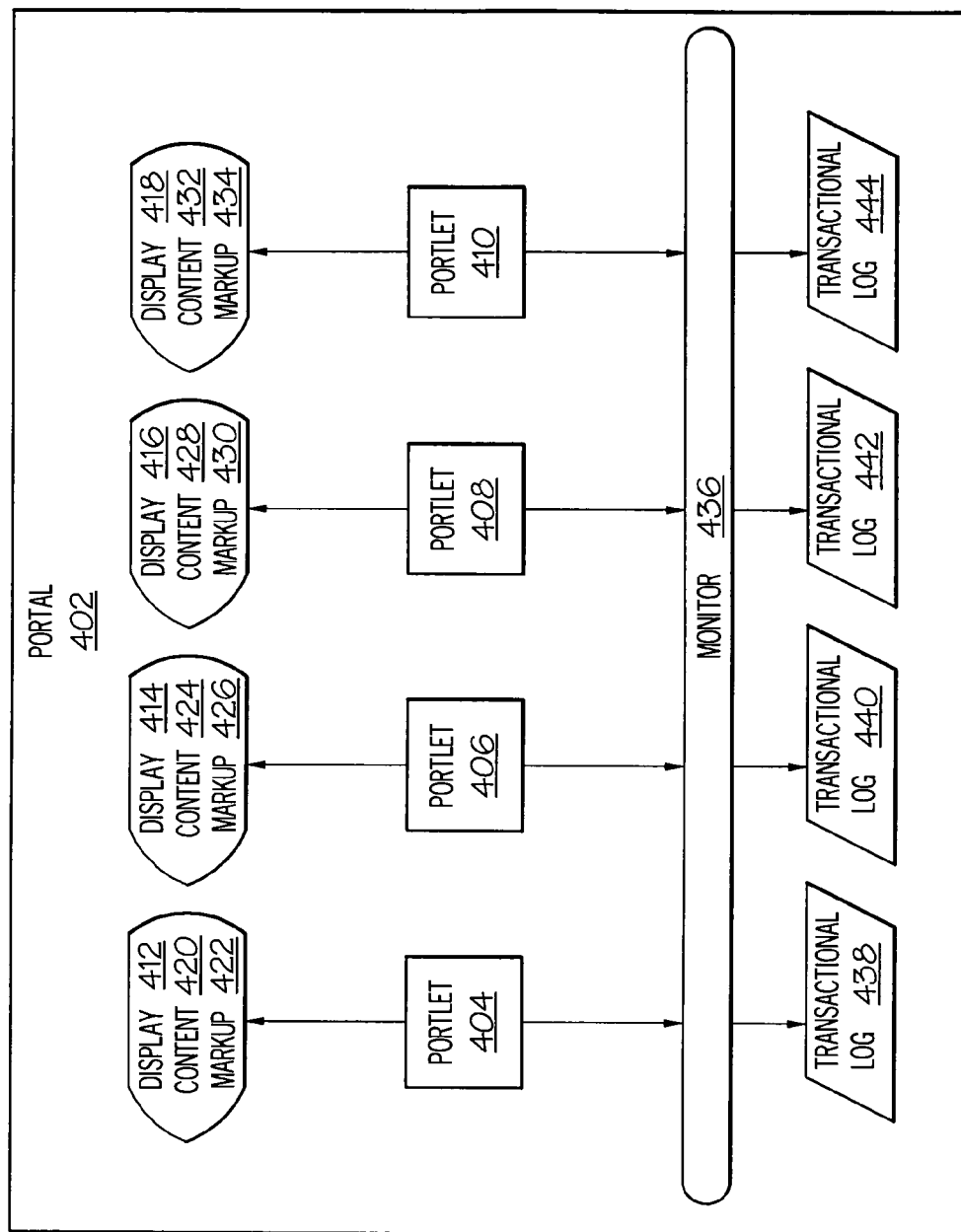
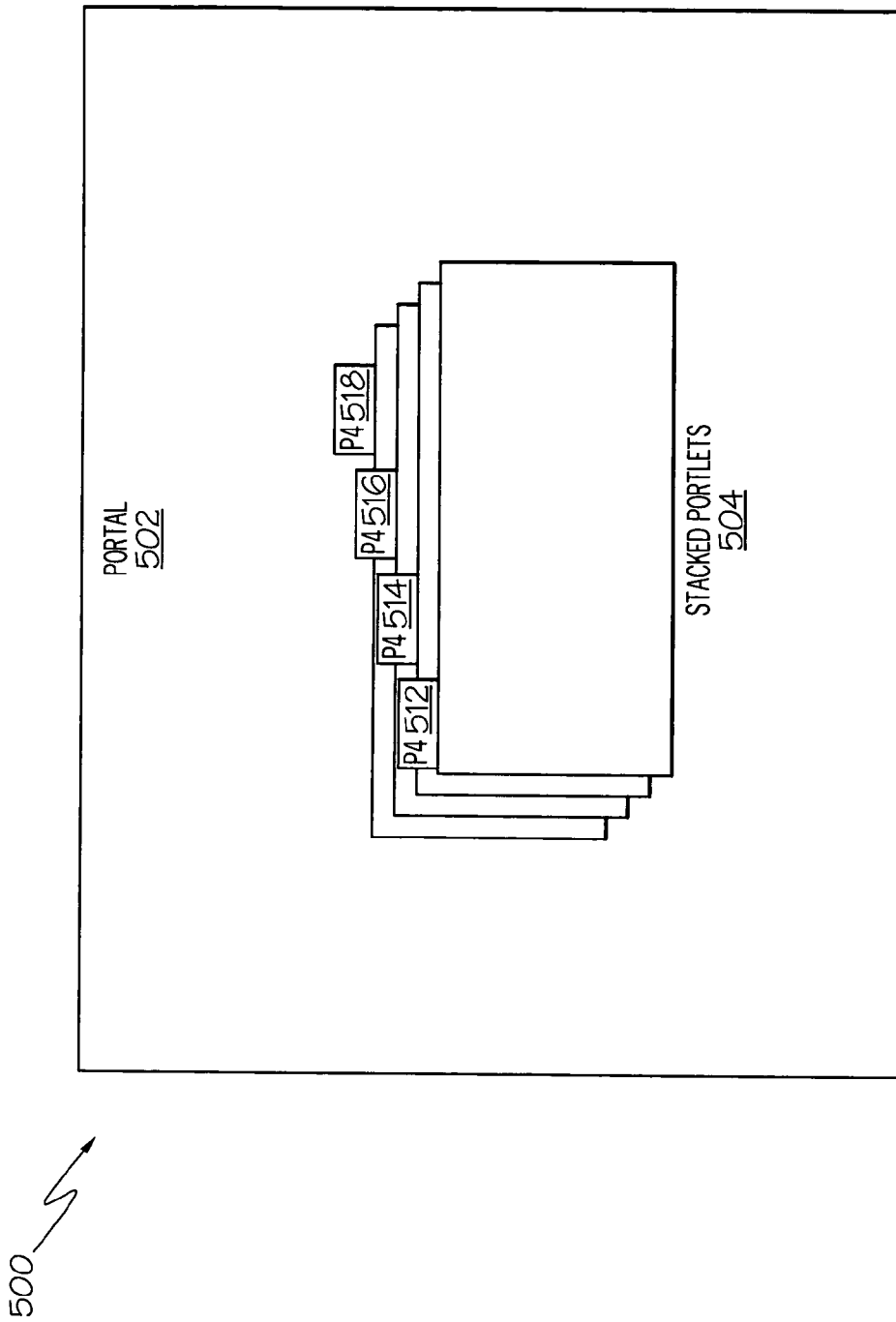


FIG. 4



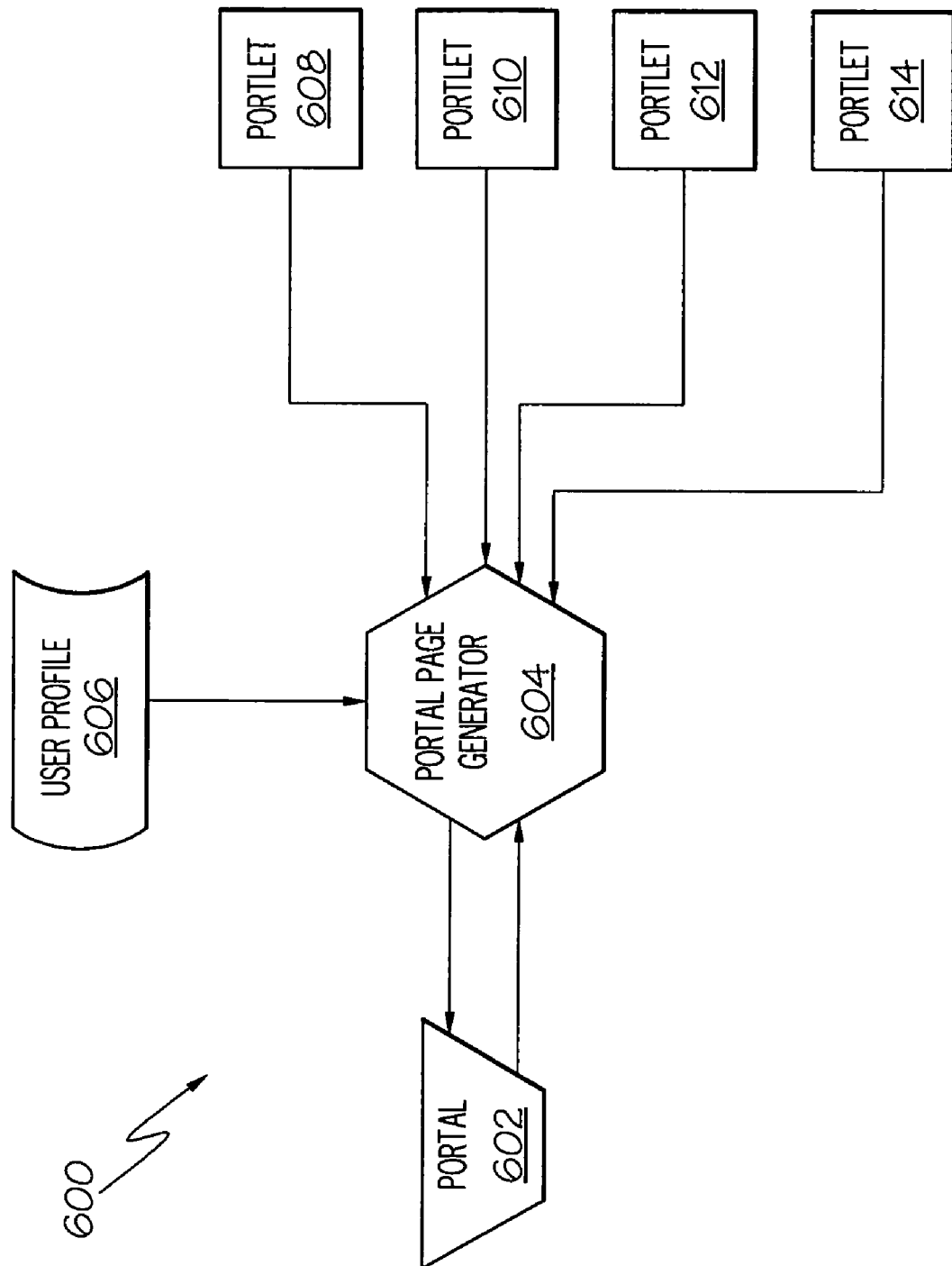


FIG. 6

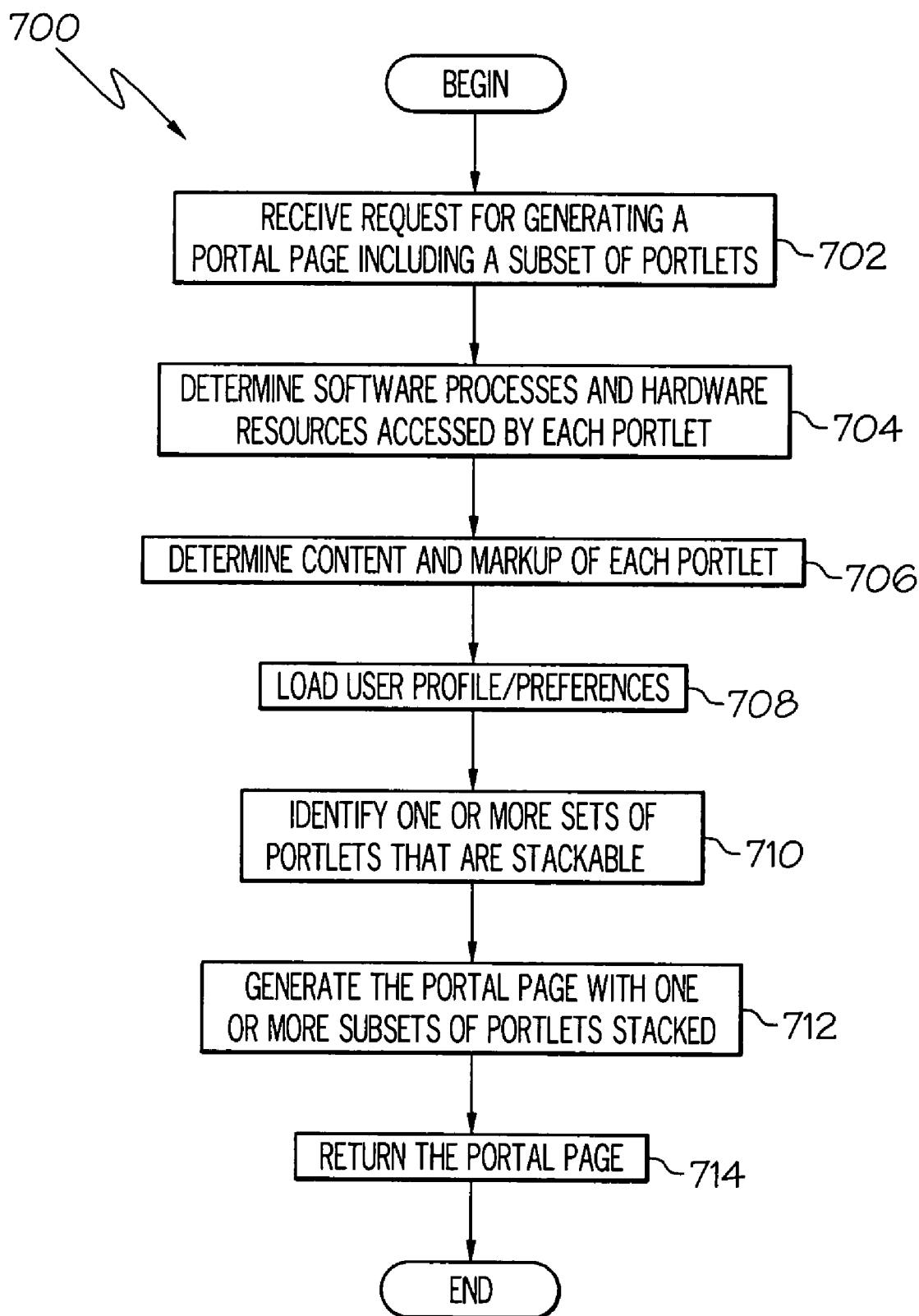


FIG. 7

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**STACKING PORTLETS IN PORTAL PAGES****BACKGROUND OF THE INVENTION****1. Field of the Invention**

The present invention relates generally to graphical user interface (GUI). Still more particularly the present invention relates to an improved method, apparatus, and computer usable code for customizing portal pages.

**2. Description of the Related Art**

A portal displays information aggregated from different sources. The information is customized for a specific user and is dynamically updated. The user interacts with the portal by specifying what information is displayed and how it is displayed. A user may customize a portal by specifying the user's preferences so that each time the user accesses the portal, the portal checks the user's preferences and displays the information that the user wants in the form in which the user wants the information to be displayed. The user may also vary which information is displayed or how it is displayed by interacting with the portal in real-time in addition to using user preferences.

For example, a user can specify which publicly traded companies the user is interested in and the portal may display stock quotes and recent news items about those companies. Because each user may be interested in different companies, each user's portal displays only what that user wants to see and in the way the user wants to see it. A portal may also be used to monitor a computer network by monitoring the status of different network resources.

Each time a user preference is added, the portlet(s) associated with that preference are added to the portal. Thus, customization of a portal page may result in many portlets being crowded into the portal page, which may result in a cluttered portal that makes it difficult for the user to view all the portlets clearly.

**BRIEF SUMMARY OF THE INVENTION**

The present invention provides a method, apparatus, and computer useable code for displaying information from a plurality of portlets. A portal is comprised of a plurality of portlets. Each portlet accesses hardware and software to gather data. Each portlet offers information to the portal page. Each portlet's information has a specific content type and markup. A subset of portlets is determined stackable if the subset of portlets has in common one or more of the same hardware, software, content type, or markup. Once a subset of portlets is determined stackable, the user's preference for stacking the portlets is obtained by loading a user profile or asking the user. If the subset of portlets is stackable and the user desires the subset of portlets stacked, then the subset of portlets is stacked such that the stack of portlets presents a first portlet and a control for selecting a second portlet from within the subset of portlets that is not currently presented.

**BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS**

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

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FIG. 1 depicts a pictorial representation of a network of data processing systems in which aspects of the present invention may be implemented;

FIG. 2 is a block diagram of a data processing system that may be implemented as a server in accordance with an illustrative embodiment of the present invention;

FIG. 3 is a block diagram of portlets monitoring software processes and hardware in accordance with an embodiment of the present invention;

FIG. 4 is a block diagram of a portal with portlets in accordance with an embodiment of the present invention;

FIG. 5 is a block diagram of a portal with stacked portlets in accordance with an embodiment of the present invention;

FIG. 6 is a block diagram of a portal architecture in accordance with an embodiment of the present invention; and

FIG. 7 depicts a flowchart illustrating how portlets are stacked in accordance with an embodiment of the present invention.

**DETAILED DESCRIPTION OF THE INVENTION**

FIGS. 1 and 2 are provided as exemplary diagrams of data processing environments in which embodiments of the present invention may be implemented. It should be appreciated that FIGS. 1 and 2 are only exemplary and are not intended to assert or imply any limitation with regard to the environments in which aspects or embodiments of the present invention may be implemented. Many modifications to the depicted environments may be made without departing from the spirit and scope of the present invention.

Typically, a user sends a request to a portal page generator to create a portal. The request to create a portal may involve accessing a specific web page, logging on to a specific web page, or other means. Typically, each portal is customized to a specific user's requirements. A given portal displays information aggregated from different sources and the information is dynamically updated while the portal is being generated. Each source may be hosted by a different web server.

If the user's identity is sent with the request to generate the portal page, then a user profile may be loaded and the portal generated based on information in the user's profile. The user's identity may be determined by asking the user to login, a cookie placed on the user's computer or other means.

If there is no user profile then a default profile may be used. The user may specify what information is displayed and how it is displayed and these preferences may be stored in the user's profile, so that each time the user accesses the portal, the portal loads the user's profile and displays the appropriate information in the appropriate form. The user may also vary which information is displayed or how it is displayed by interacting with the portal in real-time in addition to specifying that information in a user profile.

For example, if a user specifies which publicly traded companies the user is interested in, then the portal will display stock quotes and recent news items about those companies. Because each user may be interested in different companies, each user's portal displays only what that user wants to see and in the way the user wants to see it. A portal may also be used to monitor a computer network by monitoring the status of different network resources.

Typically, each piece of information displayed on a portal page is created by a portlet. The portlet accesses specific software processes or hardware to gather information. The portlet then takes the gathered information, and displays it on the portal page using a markup language user interface component.



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Each time a user requests additional information be displayed on the portal page the portlet(s) associated with that information are added to the portal. Thus, customization of a portal page may result in many portlets being crowded into the portal page, which may result in a cluttered portal that makes it difficult for the user to view all the portlets clearly.

This invention provides an improved method, apparatus, and computer useable code for organizing the portlets as the number of portlets displayed increases to prevent the portal from becoming crowded.

With reference now to the figures, FIG. 1 depicts a pictorial representation of a network of data processing systems in which aspects of the present invention may be implemented. Network data processing system 100 is a network of computers in which embodiments of the present invention may be implemented. Network data processing system 100 contains a network 102, which is the medium used to provide communications links between various devices and computers connected together within network data processing system 100. Network 102 may include connections, such as wire, wireless communication links, or fiber optic cables.

In the depicted example, server 104 connects to network 102 along with storage unit 106. In addition, clients 108, 110, and 112 connect to network 102. These clients 108, 110, and 112 may be, for example, personal computers or network computers. In the depicted example, server 104 may be a web server that provides portal pages and applications to clients 108-112. Clients 108, 110, and 112 are clients to server 104. Network data processing system 100 may include additional servers, clients, and other devices not shown.

In the depicted example, network data processing system 100 is the Internet with network 102 representing a worldwide collection of networks and gateways that use the Transmission Control Protocol/Internet Protocol (TCP/IP) suite of protocols to communicate with one another. At the heart of the Internet is a backbone of high-speed data communication lines between major nodes or host computers, consisting of thousands of commercial, government, educational and other computer systems that route data and messages. Of course, network data processing system 100 also may be implemented as a number of different types of networks, such as for example, an intranet, a local area network (LAN), or a wide area network (WAN). FIG. 1 is intended as an example, and not as an architectural limitation for different embodiments of the present invention.

Referring to FIG. 2, a block diagram of a data processing system that may be implemented as a server, such as server 104 in FIG. 1, is depicted in accordance with an illustrative embodiment of the present invention. Data processing system 200 may be asymmetric multiprocessor (SMP) system including a plurality of processors 202 and 204 that connect to system bus 206. Alternatively, a single processor system may be employed. Also connected to system bus 206 is memory controller/cache 208, which provides an interface to local memory 209. I/O bus bridge 210 connects to system bus 206 and provides an interface to I/O bus 212. Memory controller/cache 208 and I/O bus bridge 210 may be integrated as depicted.

Peripheral component interconnect (PCI) bus bridge 214 connects to I/O bus 212 provides an interface to PCI local bus 216. A number of modems may be connected to PCI local bus 216. Typical PCI bus implementations will support four PCI expansion slots or add-in connectors. Communications links to clients 108-112 in FIG. 1 may be provided through modem 218 and network adapter 220 connected to PCI local bus 216 through add-in connectors.

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Additional PCI bus bridges 222 and 224 provide interfaces for additional PCI local buses 226 and 228, from which additional modems or network adapters may be supported. In this manner, data processing system 200 allows connections to multiple network computers. A memory-mapped graphics adapter 230 and hard disk 232 may also be connected to I/O bus 212 as depicted, either directly or indirectly.

Those of ordinary skill in the art will appreciate that the hardware depicted in FIG. 2 may vary. For example, other peripheral devices, such as optical disk drives and the like, also may be used in addition to or in place of the hardware depicted. The depicted example is not meant to imply architectural limitations with respect to the present invention.

The data processing system depicted in FIG. 2 may be, for example, an IBM eServer™ pSeries® computer system, running the Advanced Interactive Executive (AIX®) operating system or LINUX operating system (eServer, pSeries and AIX are trademarks of International Business Machines Corporation in the United States, other countries, or both while Linux is a trademark of Linus Torvalds in the United States, other countries, or both).

Those of ordinary skill in the art will appreciate that the hardware in FIGS. 1 and 2 may vary depending on the implementation. Other internal hardware or peripheral devices, such as flash memory, equivalent non-volatile memory, or optical disk drives and the like, may be used in addition to or in place of the hardware depicted in FIGS. 1 and 2. Also, the processes of the present invention may be applied to a multi-processor data processing system.

Referring to FIG. 3, the reference numeral 300 generally designates a block diagram showing portlets monitoring one or more resources in accordance with an embodiment of the present invention. A resource may be a software process, a hardware subsystem, or a similar network resource.

FIG. 3 comprises portlets 302, 304, 306, and 308, software processes 310, 312, and 314, hardware 316, 318, and 320, monitor 322, and transactional logs 324, 326, 328, and 330. The software processes and hardware may reside anywhere in the computer network. The number of portlets, software processes, and hardware shown are purely for purposes of illustration and are not meant to imply architectural limitations with respect to the invention.

In this example, portlet 302 accesses hardware 316, software process 310 and software process 312. Portlet 304 accesses software process 312 and software process 314. Portlet 306 accesses software process 312, software process 314, hardware 318, and hardware 320. Portlet 308 accesses software process 310, software process 312, hardware resource 316, hardware resource 318 and hardware resource 320.

Monitor 322 monitors portlets 302, 304, 306, and 308 and produces a transactional log for each portlet. Thus, transactional log 324 corresponds to portlet 302, transactional log 326 corresponds to portlet 304, transactional log 328 corresponds to portlet 306, and transactional log 330 corresponds to portlet 308.

Transactional logs 324, 326, 328 and 330 each contain information about the resources, such as software processes and hardware that each portlet accesses to gather data. By comparing transactional logs, an application such as a portal page generator can determine whether two or more portlets are accessing the same resources or the same type of resources. Portlets that access the same resources or same type of resources are considered stackable and may be stacked based on the user's preferences. Note that additional items, such as content and markup, may also be looked at when determining whether two or more portlets are stackable.

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Any characteristic of a portlet, such as the resource monitored or the output display may be used to compare two or more portlets to determine if they are stackable.

For example, portlet **302** and portlet **308** both access resources **310**, **312**, and **316** and can be stacked if a stackable portlet requires three or more common characteristics. If two or more common characteristics are required, portlet **304** and portlet **306** both monitor **312** and **314**, and therefore, may be stackable. If only one common characteristic is required, **302**, **304**, **306**, and **308** may be stackable because **312** is common. See Table 1.

TABLE 1

Number in common	Common Software Process or Hardware	Stackable Portlets
1	312	302, 304, 306, 308
2	312, 314	304 and 306
3	310, 312, 316	302 and 308
3	312, 318, 320	306 and 308

The rules for when to stack may be based on how many characteristics the portlets have in common. Two or more portlets are stackable if they have sufficient elements in common, where sufficient is predefined by a user. When two or more portlets are determined to be stackable, the user may be asked whether the user wishes to stack the portlets or the portal may automatically stack the portlets based on rules pre-defined by the user. For example, two or more portlets may be stacked only if they access at least two common elements or only if at least 50% of each portlet's accessed elements are common. Any graphical user interface capable of displaying portlets, such as a portal, may be used.

Referring to FIG. 4, numeral **400** generally designates a block diagram showing a portal with portlets in accordance with an embodiment of the present invention.

Portal **402** comprises portlet **404**, **406**, **408**, and **410**. Portlet **404** outputs to display **412**, portlet **406** outputs to display **414**, portlet **408** outputs to display **416**, and portlet **410** outputs to display **418**. Display **412** comprises content **420** and markup **422**, display **414** comprises content **424** and markup **426**, display **416** comprises content **428** and markup **430**, and display **418** comprises content **432** and markup **434**.

Monitor **436** monitors portlets **404**, **406**, **408**, and **410** and produces a transactional log for each portlet. Thus, transactional log **438** corresponds to portlet **404**, transactional log **440** corresponds to portlet **406**, transactional log **442** corresponds to portlet **408**, and transactional log **444** corresponds to portlet **410**. Each transactional log contains information as to which elements, hardware and software processes, for example, that each portlet accesses.

FIG. 4 depicts an example of the portlets prior to stacking. Portal **402** compares the common characteristics of a portal, such as the transactional log, content and markup of each portlet, to determine if there is sufficient commonality between two or more portlets to consider the portlets stackable. For example, to determine if portlets **404** and **406** are stackable, portal **402** may look at transaction logs **438** and **440**, contents **420** and **424**, and markups **422** and **426**. If portal **402** finds portlets **404** and **406** access common resources or display common content or markup, then portal **402** may consider portlets **404** and **406** stackable.

Referring to FIG. 5, numeral **500** generally designates a block diagram showing a portal with stacked portlets in accordance with an embodiment of the present invention.

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Portal **502** comprises stacked portlet **504**. Stacked portlet **504** comprises portlets **512**, **514**, **516** and **518**.

FIG. 5 is an example of how, once two or more portlets have been determined to be stackable and the user has allowed them to be stacked, the portal displays stacked portlets. In this example, portlets **512**, **514**, **516**, and **518** have been determined stackable because they access common resources or because they display common content or markup.

Two or more portlets typically occupy less space when stacked than they do when displayed individually, thereby reducing portlet clutter. The user may toggle between the individual portlets that comprise a specific stacked portlet by using tabs, forward and back buttons, cascading, scroll bars, or any other similar stacking and selection method.

For example, multiple scroll bars may be used to navigate a set of stacked portlets, with each scroll bar navigating a different set of portlet characteristics. A vertical scroll bar could allow the user to go lower or higher in the hierarchy of a set of portlets while the horizontal scroll bar could allow the user to navigate between portlets at the same level in the hierarchy. For example, the vertical scroll bar could select between viewing a stock index like the Dow Jones Industrial Average (DJIA) to viewing an individual stock that is a component of the DJIA, while the horizontal scroll bar could select which stock index (DJIA, Standard and Poors 500, etc.) or which individual stock to view, depending on the setting of the vertical scroll bar.

This technique may be used, for example, to present an entire portal as a stack of portlets so that one given portlet is presented on top of the stack at a given time. This would be useful, for example, when presenting a portal on a device with limited screen real estate such as a smartphone or personal digital assistant (PDA).

This technique may also be used, for example, to take a large number of portlets and present more than one portlet, with the control selecting another set of portlets not currently presented. For example, forty portlets could be stacked with five portlets presented, and the control selecting five portlets not presented.

Referring to FIG. 6, the reference numeral **600** generally designates a block diagram showing a portal architecture in accordance with an embodiment of the present invention. FIG. 6 illustrates portal **602**, portal page generator **604**, user preferences **606**, and portlets **608**, **610**, **612**, and **614**.

Portal page generator **604** is a server application that dynamically generates a portal page comprised of portlets. The portal page may be generated using Java or other language. The portal page may contain a markup language such as hypertext markup language (HTML) or extensible markup language (XML). The portal page generator may be an active server page generator, for example.

When a user requests a portal page, portal page generator **604** may receive information about the client's identity. If portal page generator **604** receives the user's identity, portal page generator **604** then loads user profile **606**. The user's identity may be obtained through the use of a cookie, asking the user to login, or other similar means. If portal page generator **604** does not receive the identity of the user, user profile **606** may be a default set of user preferences. Once portal page generator **604** has the user's preferences, portal page generator **604** activates the portlets required to display the information for those user preferences.

In this example portlets **608**, **610**, **612**, and **614** are required to display the information for portal **602** based on user profile **606**. Based on user profile **606**, portal page generator **604** can determine if any of portlets **608**, **610**, **612** and **614** are stackable. That is, portal page generator **604** may examine the

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software processes and hardware that portlets **608**, **610**, **612** and **614** access, as well as the content and markup of each portlet's respective display, and determine which portlets have sufficient commonality to be stackable. Portal page generator **604** may then ask the client whether to stack the portlets. Alternatively, portal page generator **604** may automatically stack the portlets without prompting the user. The portlets might automatically be stacked because that is the default setting or because portal page generator **604** knows that the portal is being displayed on a screen with very little real estate, such as that of a PDA.

Referring to FIG. 7, the reference numeral **700** generally designates a flowchart illustrating how portlets are stacked in accordance with an embodiment of the present invention. Operation begins when a portal page generator receives a request to generate a portal page including a plurality of portlets in block **702**. The software and hardware resources each portlet accesses is determined in block **704**. The content and markup of the information each portlet displays is determined in block **706**. The user's profile/preferences are obtained in block **708**. The user's profile/preferences may be obtained, for example, by loading the user's profile or asking the user. A commonality in a subset of portlets is identified in block **710**, and, based on the commonality, which portlets are stackable. Based on which portlets have been identified as stackable, the portal is generated with one or more subsets of portlets stacked in block **712**. Finally, the portal page is returned in block **714**, and operation ends.

The invention can take the form of an entirely hardware embodiment, an entirely software embodiment or an embodiment containing both hardware and software elements. In a preferred embodiment, the invention is implemented in software, which includes but is not limited to firmware, resident software, microcode, etc.

Furthermore, the invention can take the form of a computer program product accessible from a computer-usable or computer-readable medium providing program code for use by or in connection with a computer or any instruction execution system. For the purposes of this description, a computer-usable or computer readable medium can be any apparatus that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device.

The medium can be an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system (or apparatus or device) or a propagation medium. Examples of a computer-readable medium include a semiconductor or solid state memory, magnetic tape, a removable computer diskette, a random access memory (RAM), a read-only memory (ROM), a rigid magnetic disk and an optical disk. Current examples of optical disks include compact disk—read only memory (CD-ROM), compact disk—read/write (CD-R/W) and DVD.

A data processing system suitable for storing and/or executing program code will include at least one processor coupled directly or indirectly to memory elements through a system bus. The memory elements can include local memory employed during actual execution of the program code, bulk storage, and cache memories which provide temporary storage of at least some program code in order to reduce the number of times code must be retrieved from bulk storage during execution.

Input/output or I/O devices (including but not limited to keyboards, displays, pointing devices, etc.) can be coupled to the system either directly or through intervening I/O controllers.

Network adapters may also be coupled to the system to enable the data processing system to become coupled to other

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data processing systems or remote printers or storage devices through intervening private or public networks. Modems, cable modem and Ethernet cards are just a few of the currently available types of network adapters.

The description of the present invention has been presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in order to best explain the principles of the invention, the practical application, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.

What is claimed is:

1. A method of generating a portal page, wherein the portal page includes a plurality of includes a plurality or portlets, the method comprising:

determining whether a subset of portlets is stackable; and responsive to the subset of portlets being stackable, identifying two or more stacks of portlets that are stackable, and generating the portal page such that the two or more stacks of portlets are generated as a stack of stacks, wherein the stack of stacks presents a first stack of portlets and a control for selecting a second stack of portlets from within the two or more stacks of portlets that is not currently presented.

2. The method of claim 1, wherein determining whether the subset of portlets is stackable includes:

examining software processes and hardware resources each portlet accesses; and identifying at least one software process or hardware resource common to the subset of portlets.

3. The method of claim 1, wherein determining whether the subset of portlets is stackable includes:

examining content elements and markup elements each portlet displays; and identifying at least one content element or markup element common to the subset of portlets.

4. The method of claim 1, wherein determining whether the subset of portlets is stackable includes:

obtaining a user's preference for stacking portlets by loading a user profile, wherein the subset of portlets is determined to be stackable based on the user's preference.

5. The method of claim 1, wherein determining whether the plurality of portlets is stackable includes:

obtaining a user's preference for stacking portlets by querying the user, wherein the subset of portlets is determined to be stackable based on the user's preference.

6. The method of claim 1, wherein the control is a tab, a scroll bar, a button, or a link.

7. An apparatus comprising:

a processor connected to a memory storing instructions that when executed by the processor provide for:

a plurality of portlet generators, wherein each portlet generator generates a portlet; and

a portal page generator, wherein the portal page generator receives a client request for a portal page that includes a subset of portlets, examines the subset of portlets, identifies at least one commonality in the subset of portlets, determines whether the subset of portlets is stackable, and, responsive to the subset of portlets being stackable, identifies two or more stacks of portlets that are stackable, and generating the portal page such that the two or more stacks of portlets are generated as a stack of stacks, wherein the stack of stacks presents a first stack of port-

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lets and a control for selecting a second stack of portlets from within the two or more stacks of portlets that is not currently presented.

8. The apparatus of claim 7, wherein the portal page generator determines whether the subset of portlets is stackable by examining software processes and hardware resources each portlet accesses, and identifying at least one software process or hardware resource common to the subset of portlets.

9. The apparatus of claim 7, wherein the portal page generator determines whether the subset of portlets is stackable by examining content elements and markup elements each portlet displays, and identifying at least one content element or markup element common to the subset of portlets.

10. The apparatus of claim 7, wherein the portal page generator determines whether the plurality of portlets is stackable by obtaining a user's preference for stacking portlets by loading a user profile, wherein the subset of portlets is determined to be stackable based on the user's preference.

11. The apparatus of claim 7, wherein the portal page generator determines whether the plurality of portlets is stackable by obtaining a user's preference for stacking portlets by querying the user wherein the subset of portlets is determined to be stackable based on the user's preference.

12. The apparatus of claim 7, wherein the control is a tab, a scroll bar, a button, or a link.

13. A computer program product for generating a portal page, wherein the portal page includes a plurality of portlets, said computer program including:

a computer usable medium including computer usable program code stored thereon, the computer usable program code comprising:

computer usable program code for determining whether a subset of portlets is stackable; and

computer usable code responsive to the subset of portlets being stackable, for identifying two or more stacks of portlets that are stackable, and generating the portal page such that the two or more stacks of portlets are generated

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as a stack of stacks, wherein the stack of stacks presents a first stack of portlets and a control for selecting a second stack of portlets from within the two or more stacks of portlets that is not currently presented.

14. The computer program product of claim 13, wherein the computer usable program code for determining whether the subset of portlets is stackable includes:

computer usable program code for examining software processes and hardware resources each portlet accesses; and

computer usable program code for identifying at least one software process or hardware resource common to the subset of portlets.

15. The computer program product of claim 13, wherein the computer usable program code for determining whether the subset of portlets is stackable includes:

computer usable program code for examining content elements and markup elements each portlet displays; and computer usable program code for identifying at least one content element or markup element common to the subset of portlets.

16. The computer program product of claim 13, wherein the computer usable program code for determining whether the subset of portlets is stackable includes:

computer usable program code for obtaining a user's preference for stacking portlets by loading a user profile, wherein the subset of portlets is determined to be stackable based on the user's preference.

17. The computer program product of claim 13, wherein the computer usable program code for determining whether the subset of portlets is stackable includes:

computer usable program code for obtaining a user's preference for stacking portlets by querying the user, wherein the subset of portlets is determined to be stackable based on the user's preference.

18. The computer program product of claim 13, wherein the control is a tab, a scroll bar, a button, or a link.

\* \* \* \* \*

# **EXHIBIT 7**





**DESMARAIS** LLP

# **Zillow Infringes U.S. Patent No. 7,543,234 (Daniels)**

*Subject to Fed. R. Evid. 408*



# U.S. Patent No. 7,543,234 (Daniels) - Overview

(12) <b>United States Patent</b> <b>Daniels et al.</b>	(10) <b>Patent No.:</b> <b>US 7,543,234 B2</b> (45) <b>Date of Patent:</b> <b>Jun. 2, 2009</b>
(54) <b>STACKING PORTLETS IN PORTAL PAGES</b>  (75) Inventors: <b>Fonda J. Daniels</b> , Cary, NC (US); <b>David Bruce Kumhyr</b> , Austin, TX (US); <b>Paul Franklin McMahan</b> , Apex, NC (US)	2002/0038228 A1 3/2002 Waldorf et al. .... 705/7 2002/0046257 A1 4/2002 Killmer ..... 709/218 2002/0167538 A1 11/2002 Bhetanabhotla ..... 345/700
(73) Assignee: <b>International Business Machines Corporation</b> , Armonk, NY (US)	(Continued)  FOREIGN PATENT DOCUMENTS
( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 320 days.	EP 112668 A2 8/2001  OTHER PUBLICATIONS
(21) Appl. No.: <b>11/173,041</b>	Rodriguez et al., "Adding Voice to your Portlet Applications", Jul. 23, 2004, IBM, pp. 1-142. <a href="http://www.redbooks.ibm.com/redpapers/pdfs/redp3878.pdf">http://www.redbooks.ibm.com/redpapers/pdfs/redp3878.pdf</a> .
(22) Filed: <b>Jul. 1, 2005</b>	(Continued)
(65) <b>Prior Publication Data</b>  US 2007/0006083 A1 Jan. 4, 2007	<i>Primary Examiner</i> —Stephen S Hong <i>Assistant Examiner</i> —Omar Abdul-Ali (74) <i>Attorney, Agent, or Firm</i> —Yee & Associates, P.C.; Robert E. Straight, II
(51) <b>Int. Cl.</b> <b>G06F 3/00</b> (2006.01)	

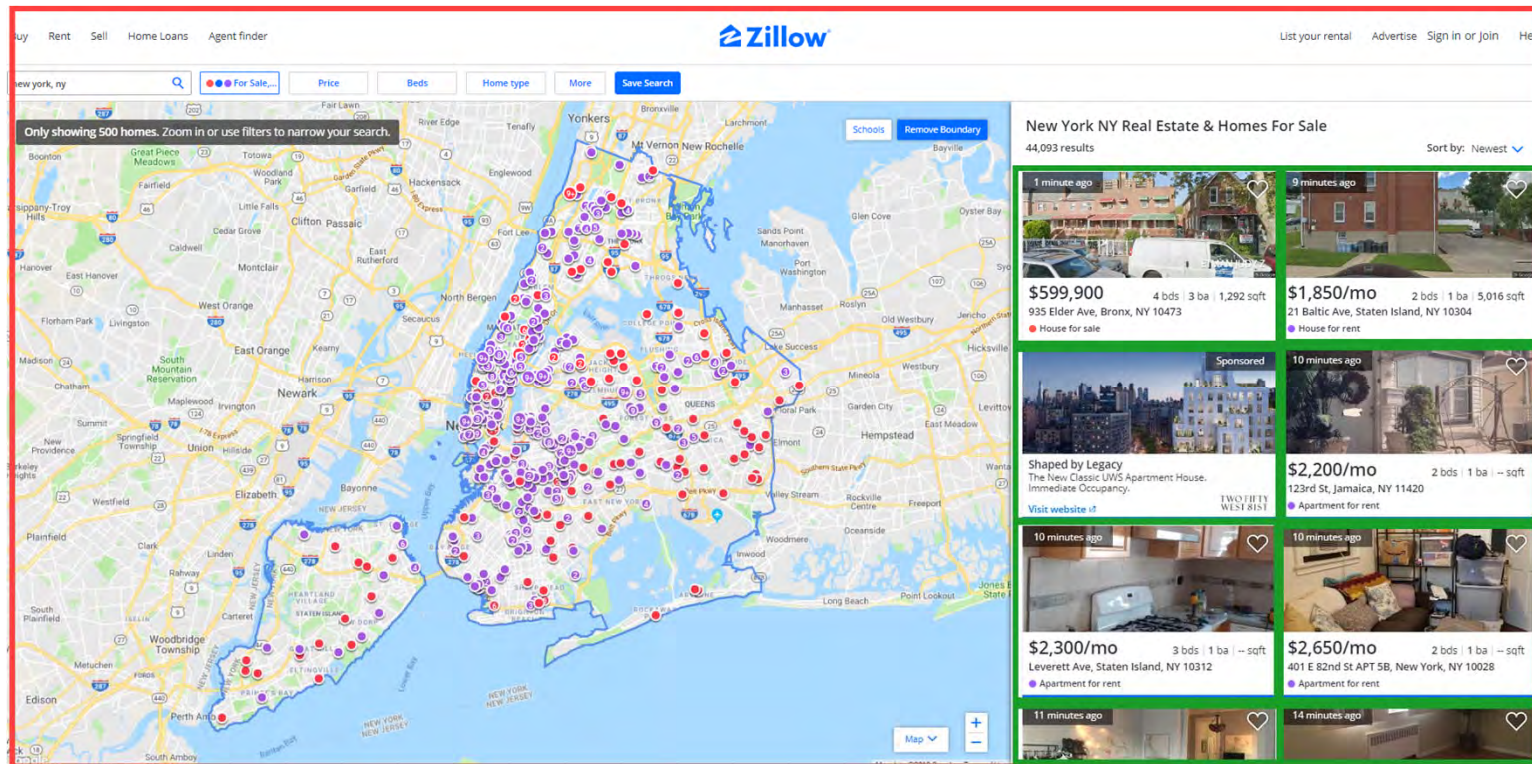
## **U.S. Patent No. 7,543,234 (Daniels) - Claim 1**

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- 1. A method of generating a portal page, wherein the portal page includes a plurality of portlets, the method comprising:**
- (a) determining whether a subset of portlets is stackable; and**
  - (b) responsive to the subset of portlets being stackable, identifying two or more stacks of portlets that are stackable, and**
  - (c) generating the portal page such that the two or more stacks of portlets are generated as a stack of stacks, wherein the stack of stacks presents a first stack of portlets and a control for selecting a second stack of portlets from within the two or more stacks of portlets that is not currently presented.**

# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

1. A method of **generating a portal page**, wherein the **portal page includes a plurality of portlets**, the method comprising:

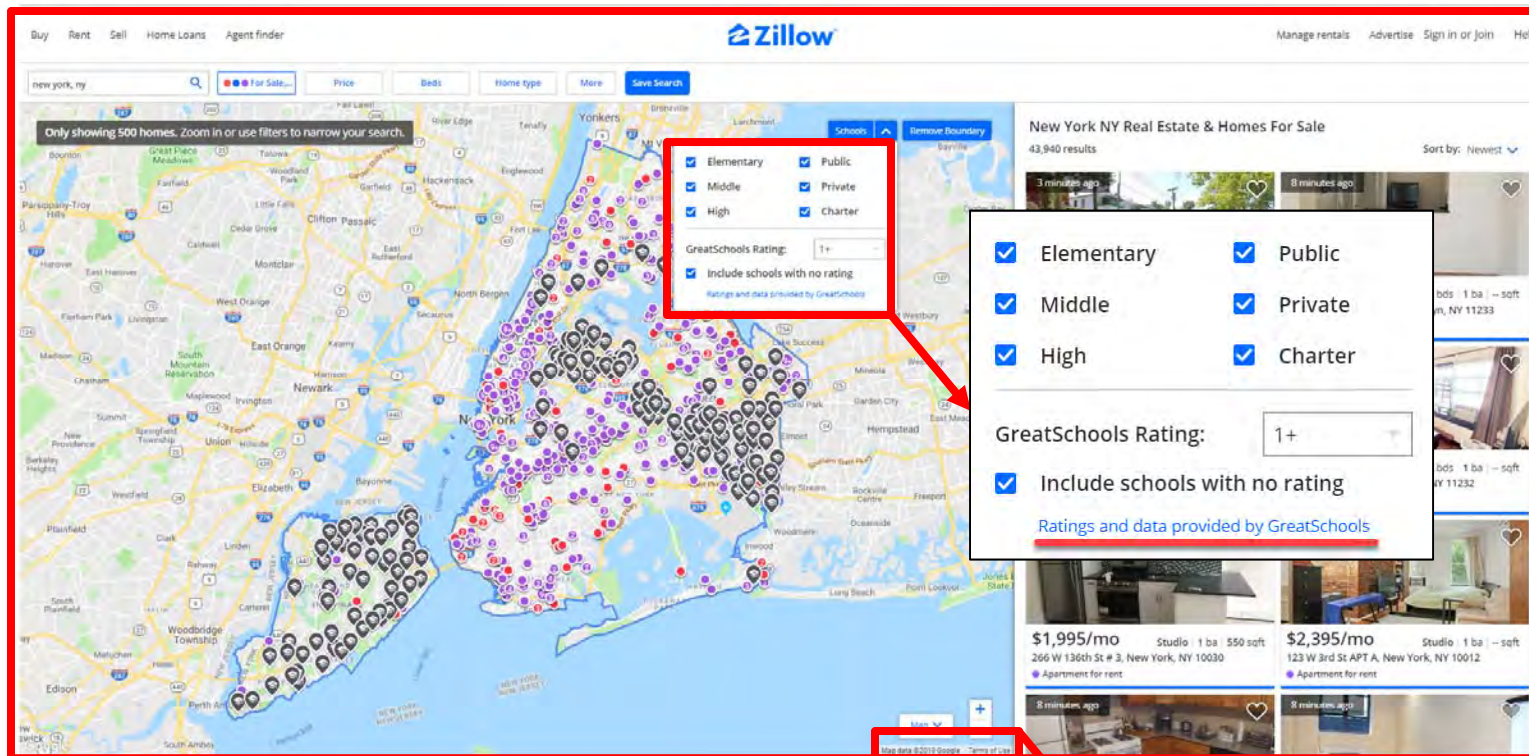


Zillow Search Results Page, <https://www.zillow.com>.



# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

1. A method of **generating a portal page**, wherein the portal page includes a plurality of portlets, the method comprising:

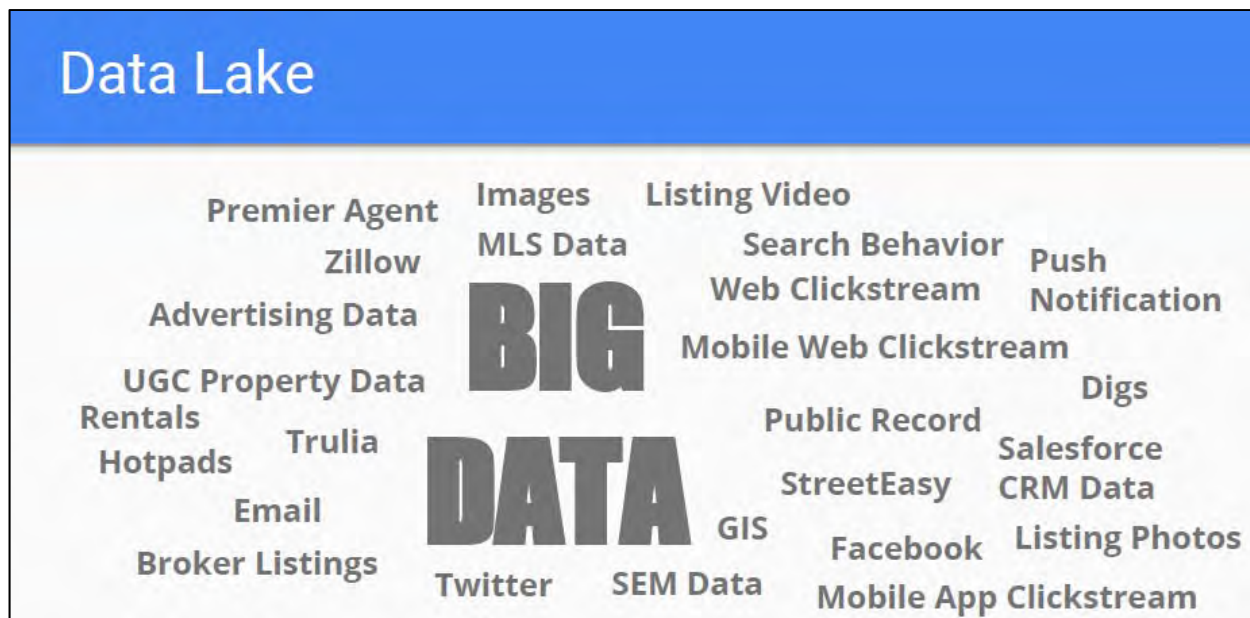


Zillow Search Results Page, <https://www.zillow.com>.

**Note:** Zillow's search results page displays information aggregated from several sources, including home listings from Zillow's database, map data from Google, and school district data from GreatSchools.

# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

1. A method of **generating a portal page**, wherein the portal page includes a plurality of portlets, the method comprising:



Zillow Group: Transforming Real Estate through Big Data and Data Science at slide 4, available at <https://www.zillow.com/tech/transforming-real-estate/>.

**IBM Note:** Zillow’s Website uses data from numerous sources, which it refers to in the aggregate as the “Data Lake.”

# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

## 1. A method of generating a portal page, **wherein the portal page includes a plurality of portlets**, the method comprising:

Zillow has a living database of more than 110 million U.S. homes, including homes for sale, homes for rent and homes not currently on the market. The database is built from a range of disparate sources, incorporating streams of county records, tax data, listings of homes for sale, listings of rental properties and mortgage information. Zillow offers advanced statistical predictive products, including the Zestimate®, the Rent Zestimate and the ZHVI® family of real estate indexes. The Zestimate is an estimate of the value of over 100 million homes and is updated every day. Data Quality is a huge factor in creating accurate estimates. In this article we will discuss the data quality challenges with public records.

Solving the Challenges of Public Records Data,  
<https://www.zillow.com/tech/public-data-challenges/>.

Zillow's data science & engineering team receives immense amounts of real estate data every second from sources such as public records, user/agent feeds and Multiple Listing Services. Traditionally, this data has been stored in Microsoft's SQL Server and processed using in-house caching techniques. As part of a fast-growing tech company with enormous amounts of data and a need to solve hard problems — like real-time Zestimates®, business intelligence and personalization — we are moving toward a scalable, highly available and fault-tolerant streaming data architecture which could enable us to process large volumes of varied data in real time.

Zillow Transitions to Streaming Data Architecture,  
<https://www.zillow.com/tech/streaming-data-architecture/>.

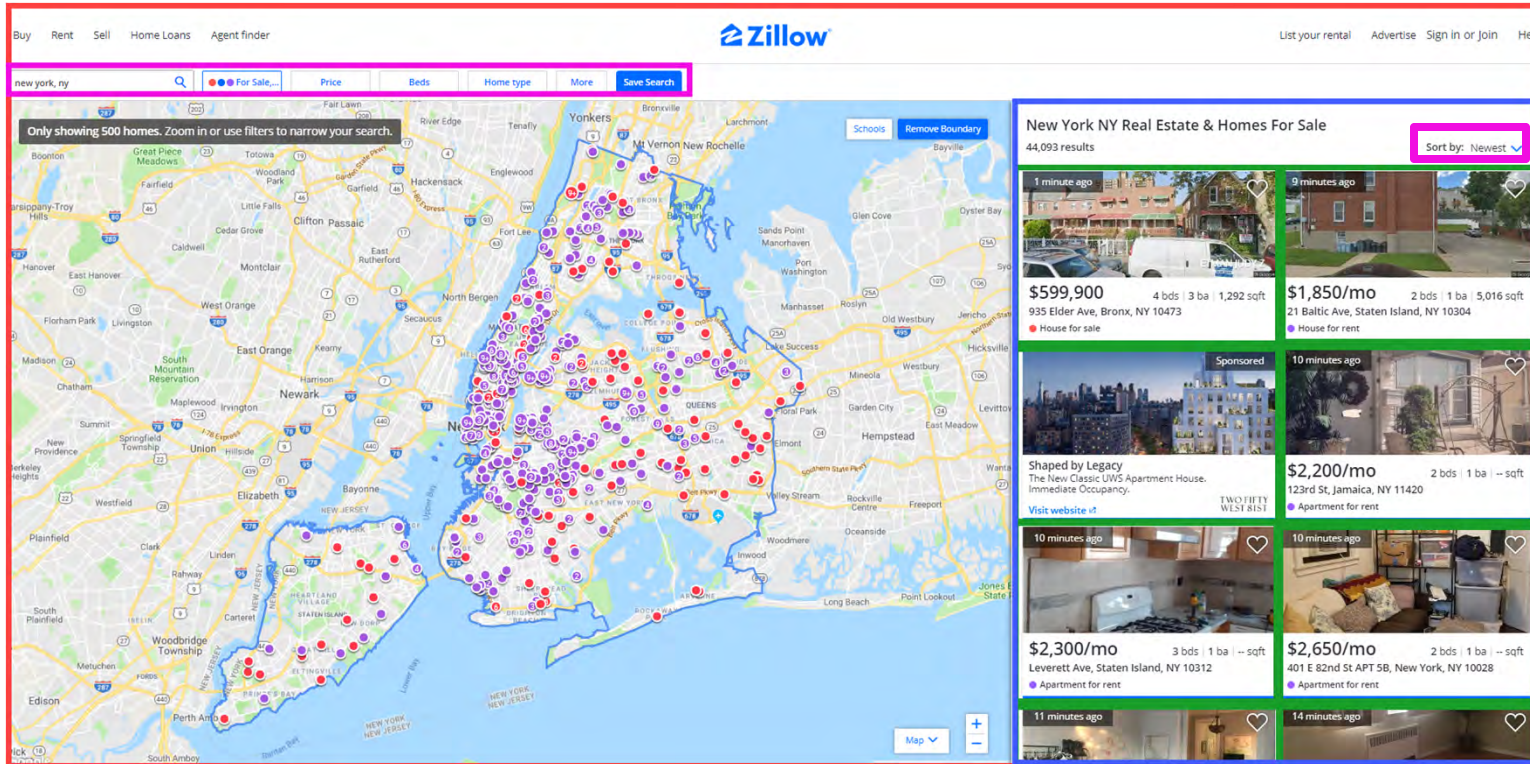
**IBM Note:** Each of the individual search result listings, or portlets, accesses Zillow's living database of homes in order to gather home listing data.

**Portlet:** “A portal is comprised of a plurality of portlets. Each portlet accesses hardware and software to gather data. Each portlet offers information to the portal page. Each portlet's information has a specific content type and markup.” (Daniels at 1:43-47).



# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

(a) determining whether a subset of portlets is stackable; and



Zillow Search Results Page, <https://www.zillow.com>.

**IBM Note:** Zillow determines which portlets to display in which order based on the specific search conducted by the user, and the specific filters selected by the user. At least “content type,” – location, whether a home is for sale or for rent, price, number of bedrooms, and home type – is the same for the subset of identified portlets.

# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

(a) determining whether a subset of portlets is stackable; and

**IBM Note:** Sets of portlets, or home listings, are stackable if they all include the criteria, or content types, selected by the user. Zillow determines which homes meet said criteria, and therefore selects the homes that may be stacked and displayed on the search results page.

## Narrow your search

Start by setting up a [search on Zillow](#) by typing in your preferred city or neighborhood. Then filter the results by identifying the key elements you're looking for:

**Listing type:** Do you want homes sold by an agent or by an owner? New construction? Foreclosures or houses coming on the market soon? All of the above? We also show you relevant houses that have recently sold and for how much. Only interested in homes with open houses? There's an option for that, too.

**Any price:** This filter lets you set minimum and maximum prices for your search so Zillow can find what's in your price range. And there's an easy calculator to help you figure out what you can afford.

**Number of bedrooms:** Looking for a studio, a manse with more than six bedrooms or anything in between? Zillow will show you what's available.

**Home type:** Are you hunting for a house, a condo or co-op, or a townhome? Or are you looking for a lot where you can build a unique home? You can pick any or see them all if you want to keep all your options open.

**More:** You also can narrow your search by number of bathrooms, the home's square footage, lot size, the minimum and maximum age of the home and how long it has been on Zillow. Plus you can add keywords like "view," "waterfront" or "pool" to target features that are important to you.

You'll see a map with pins on for-sale homes that meet your criteria. Click on a pin to see more details of each home. When you find one you love, you can "save" them so they're easily findable when you log into your Zillow account.

Tools to Help You Take Charge of Your House-Hunting Adventure, <https://www.zillow.com/home-buying-guide/how-to-find-a-house-on-zillow/>.



# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

(b) responsive to the subset of portlets being stackable, identifying two or more stacks of portlets that are stackable, and

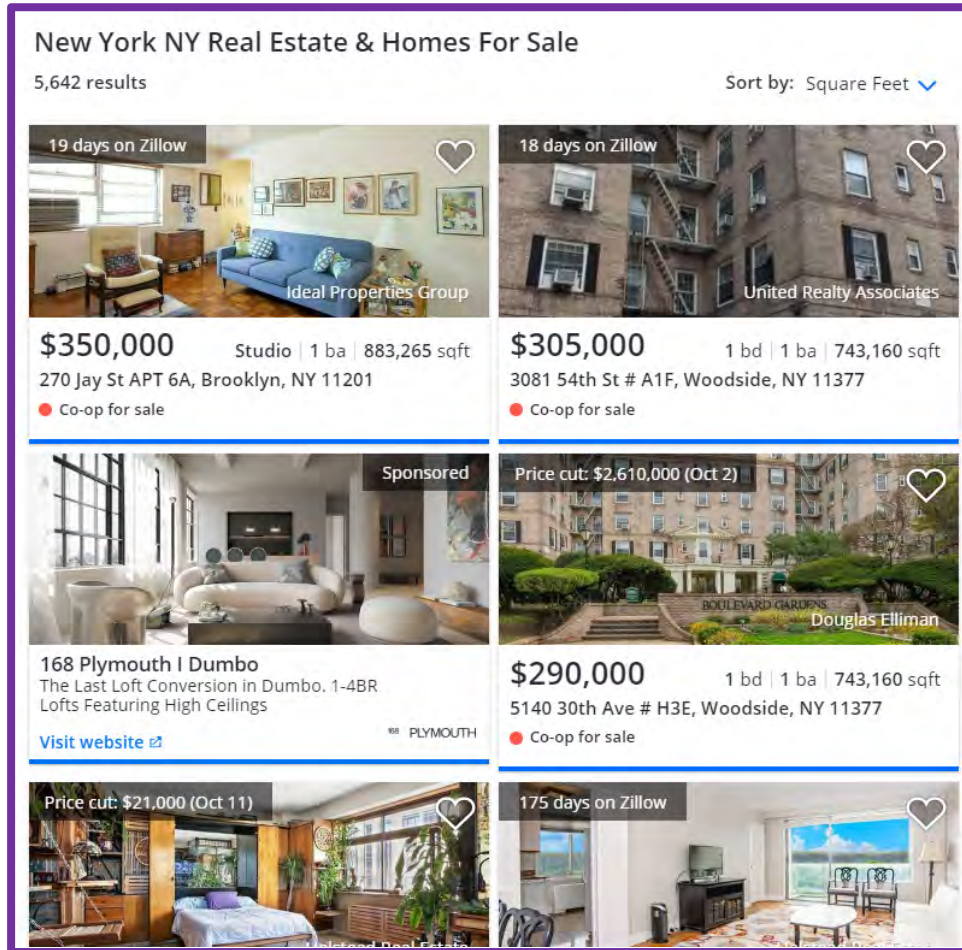
The screenshot displays the Zillow website interface. At the top, navigation links include 'Buy', 'Rent', 'Sell', 'Home Loans', and 'Agent finder'. The search bar shows 'New York, NY' with filters for 'For Sale', 'Up to \$500k', 'Beds', 'Home type', and 'More'. A map of New York, NY, is shown with numerous purple and red markers indicating property locations. To the right of the map, a list of real estate results is displayed. The first result is a house for sale at 119 Clark Ln, Staten Island, NY 10304, priced at \$374,999. The second result is a co-op for sale at 325 Marine Ave, priced at \$296,000. The third result is a loft for rent at 168 Plymouth I Dumbo, priced at \$1,200/mo. The fourth result is an apartment for rent at 16403 45th Ave # 3, Flushing, NY 11358, priced at \$2,500/mo. The fifth result is a house for rent at 68th St, Brooklyn, NY 11204, priced at \$2,100/mo. A sidebar on the right shows sorting options: 'Sort by: Newest', 'Homes for You', 'Price (High to Low)', 'Price (Low to High)', 'Newest', 'Bedrooms', 'Bathrooms', 'Square Feet', 'Lot Size', 'Zestimate (High to Low)', and 'Zestimate (Low to High)'.

Zillow Search Results Page, <https://www.zillow.com>.

**IBM Note:** Zillow performs this method when it displays “stacks” corresponding to a home search.

# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

(b) responsive to the subset of portlets being stackable, identifying two or more stacks of portlets that are stackable, and



**IBM Note:** Each “stack of portlets” within the search results page corresponds to the listings that compose the page of search results shown on the screen. For example, the stack shown on the left contains 39 portlets in total, and not the 5,642 listings (or portlets) that meet the search criteria.

Zillow Search  
Results Page,  
<https://www.zillow.com>.

# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

(b) responsive to the subset of portlets being stackable,  
identifying two or more stacks of portlets that are stackable, and

**IBM Note:** The JSON corresponding to the stack of portlets from the previous slide, or the listings visible on the search results page, only contains the 39 listings within page 1 of the total listings, instead of all 5,642 listings.

From  
GetSearchPageState.htm?se  
archQueryState=%7B%22p  
agi...%22%3Afalse%7D%7  
D%2C%22isListVisible%22  
%3Atrue%7D.

```

searchPageConstants: {monthlyInterestRate: 0.0030791666, isMobile: false,...}
searchResults: {listResults: [{zpid: "29779588", id: "29779588",...}, {zpid: "32274873", id: "32274873",...}],
hasListResults: true
hasMapResults: true
listResults: [{zpid: "29779588", id: "29779588",...}, {zpid: "32274873", id: "32274873",...}],
  0: {zpid: "29779588", id: "29779588",...}
  1: {zpid: "32274873", id: "32274873",...}
  2: {zpid: "2084233286", id: "2084233286",...}
  3: {zpid: "32285416", id: "32285416",...}
  4: {zpid: "30600221", id: "30600221",...}
  5: {zpid: "30600292", id: "30600292",...}
  6: {zpid: "32306743", id: "32306743",...}
  7: {zpid: "32284771", id: "32284771",...}
  8: {zpid: "2083242212", id: "2083242212",...}
  9: {zpid: "32271765", id: "32271765",...}
  10: {zpid: "2140406081", id: "2140406081",...}
  11: {zpid: "29795622", id: "29795622",...}
  12: {zpid: "2082935191", id: "2082935191",...}
  13: {zpid: "2145040285", id: "2145040285",...}
  14: {zpid: "112499163", id: "112499163",...}
  15: {zpid: "79716434", id: "79716434",...}
  16: {zpid: "32300483", id: "32300483",...}
  17: {zpid: "32285407", id: "32285407",...}
  18: {zpid: "32272901", id: "32272901",...}
  19: {zpid: "32276436", id: "32276436",...}
  20: {zpid: "2087674841", id: "2087674841",...}
  21: {zpid: "2098537842", id: "2098537842",...}
  22: {zpid: "30768661", id: "30768661",...}
  23: {zpid: "2082739229", id: "2082739229",...}
  24: {zpid: "2096768726", id: "2096768726",...}
  25: {zpid: "68311568", id: "68311568",...}
  26: {zpid: "32204368", id: "32204368",...}
  27: {zpid: "32284440", id: "32284440",...}
  28: {zpid: "30776397", id: "30776397",...}
  29: {zpid: "32287584", id: "32287584",...}
  30: {zpid: "143041285", id: "143041285",...}
  31: {zpid: "245179351", id: "245179351",...}
  32: {zpid: "2087748268", id: "2087748268",...}
  33: {zpid: "30768233", id: "30768233",...}
  34: {zpid: "2082586413", id: "2082586413",...}
  35: {zpid: "32160113", id: "32160113",...}
  36: {zpid: "32224626", id: "32224626",...}
  37: {zpid: "32297597", id: "32297597",...}
  38: {zpid: "68311788", id: "68311788",...}
  39: {zpid: "2083983867", id: "2083983867",...}
mapResults: [{zpid: "29779588", price: "$499,000", priceLabel: "$499K", beds: 16, baths: 3, area: 3251,
resultsHash: "368eeea0"}]
user: {isLoggedIn: false, savedSearchCount: 0, savedHomesCount: 0, personalizedSearchGaDataTag: null,...}

```



# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

(c) generating the portal page such that the two or more stacks of portlets are generated as a stack of stacks, wherein the stack of stacks presents a first stack of portlets and a control for selecting a second stack of portlets from within the two or more stacks of portlets that is not currently presented.

Buy Rent Sell Home Loans Agent finder

Zillow

Manage rentals Advertise Sign in or Join Help

New York, NY

Only showing 500 homes. Zoom in or use filters to narrow your search.

New York NY Real Estate & Homes For Sale

19,136 results

Sort by: Newest

Homes for You

Price (High to Low)

Price (Low to High)

Newest

Bedrooms

Bathrooms

Square Feet

Lot Size

Zestimate (High to Low)

Zestimate (Low to High)

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Subject to Fed. R. Evid. 408



# U.S. Patent No. 7,543,234 (Daniels) - Claim 1

(c) generating the portal page such that the two or more stacks of portlets are generated as a stack of stacks, wherein the stack of stacks presents a first stack of portlets and a control for selecting a second stack of portlets from within the two or more stacks of portlets that is not currently presented.

**Note:** This slide shows utilizing the control to select a second stack of portlets (“Price (Low to High)”) from within the two or more stacks of portlets that is not currently presented.

Zillow Search Results Page, <https://www.zillow.com>.

# U.S. Patent No. 7,543,234 (Daniels) - Claim 4

4. The method of claim 1, wherein determining whether the subset of portlets is stackable includes:

(a) obtaining a user's preference for stacking portlets by loading a user profile,

One of the core products developed by our team is a content-based home recommendation engine. The engine builds a user profile for each user and upon request makes recommendations by 1) generating a set of candidate homes and 2) ranking these homes based on a predicted match between the user profile and the candidate homes. This prediction is based on various features. Below we discuss two ways to construct input features capturing user's location preference.

Personalized Location Preference for Home Recommendations,  
<https://www.zillow.com/tech/personalized-location-preference/>.

## Personalized User Preference

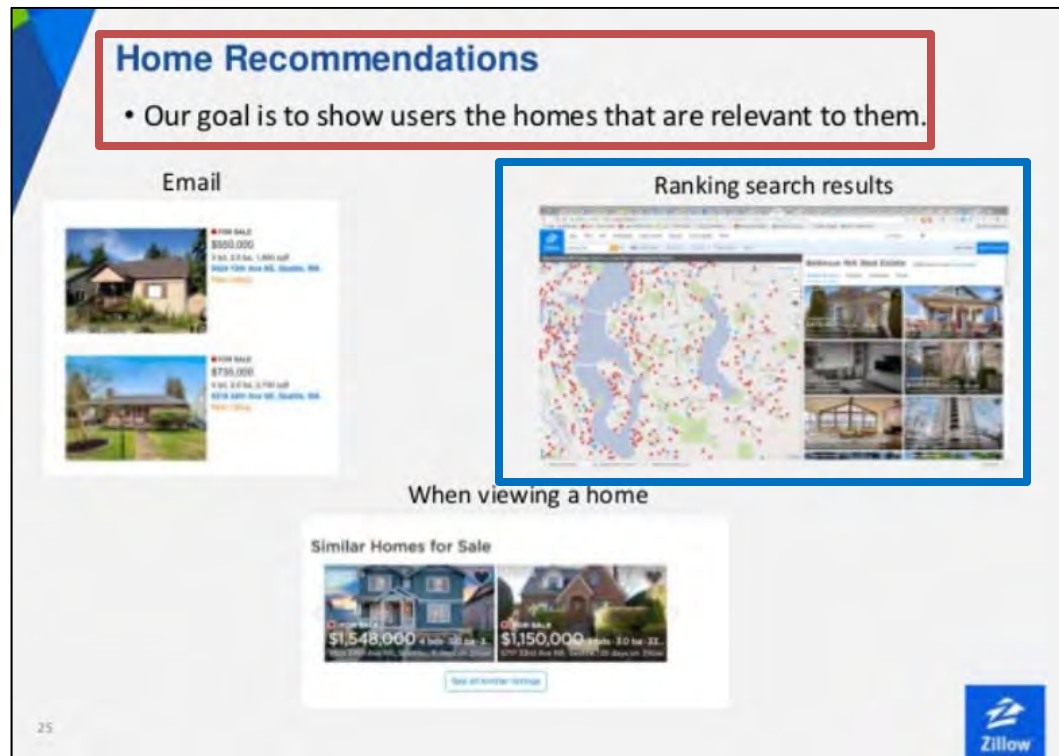
When computing personalized user preferences, we leverage the precomputed user profile, which contains a history of all recent user clicks and can therefore be used to estimate a user's interests  $c_u$  for each listings category. To improve our estimates for users with limited past click history, a Bayesian estimation is again applied to estimate the personalized user preference. Based on the method described in [1], we use a Dirichlet distribution as a prior distribution with a parameter  $\alpha_0$ , where  $\alpha_0$  is assumed to be the global user preference (our  $w_g$ ). Then the personalized user preference can be computed as:

Helping Buyers Explore the Real Estate Market via Personalized Recommendation Diversity, <https://www.zillow.com/tech/personalized-recommendation-diversity/>.

## U.S. Patent No. 7,543,234 (Daniels) - Claim 4

(b) wherein the subset of portlets is determined to be stackable based on the user's preference.

**IBM Note:** Zillow only includes home listings, or portlets, within a stack of search results if said listings are relevant to the user, or in other words, if the listings meet the user's preferences.



Overview of Data Science at Zillow at slide 25, available at [https://www.slideshare.net/njstevens/overview-of-data-science-at-zillow?qid=d518f56a-9f13-452a-9f3d-47dbbf3d29dd&v=&b=&from\\_search=6](https://www.slideshare.net/njstevens/overview-of-data-science-at-zillow?qid=d518f56a-9f13-452a-9f3d-47dbbf3d29dd&v=&b=&from_search=6).

## U.S. Patent No. 7,543,234 (Daniels) - Claim 4

(b) wherein **the subset of portlets is determined to be stackable based on the user's preference.**

One of the core products developed by our team is a content-based home recommendation engine. The engine builds a user profile for each user and upon request makes recommendations by 1) generating a set of candidate homes and 2) ranking these homes based on a predicted match between the user profile and the candidate homes. This prediction is based on various features. Below we discuss two ways to construct input features capturing user's location preference.

Personalized Location Preference for Home Recommendations,  
<https://www.zillow.com/tech/personalized-location-preference/>.

**Note:** A subset of portlets is only stacked if Zillow determines that the home listings match the user's preferences based on the user profile.

# **EXHIBIT 8**

(12) **United States Patent**  
**Lai et al.**

(10) **Patent No.:** **US 9,569,414 B2**

(45) **Date of Patent:** **\*Feb. 14, 2017**

(54) **METHOD, FRAMEWORK, AND PROGRAM PRODUCT FOR FORMATTING AND SERVING WEB CONTENT**

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(73) Assignee: **International Business Machines Corporation**, Armonk, NY (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.  
This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/602,460**

(22) Filed: **Jan. 22, 2015**

(65) **Prior Publication Data**  
US 2015/0134736 A1 May 14, 2015

#### Related U.S. Application Data

(60) Continuation of application No. 13/571,003, filed on Aug. 9, 2012, now Pat. No. 8,972,932, which is a (Continued)

(51) **Int. Cl.**  
**G06F 9/44** (2006.01)  
**G06F 17/22** (2006.01)  
(Continued)

(52) **U.S. Cl.**  
CPC ..... **G06F 17/2247** (2013.01); **G06F 9/4443** (2013.01); **G06F 9/45529** (2013.01); **H04L 67/42** (2013.01)

(58) **Field of Classification Search**  
CPC G06F 17/2247; G06F 9/4443; G06F 9/45529; G06F 8/33; G06F 8/71; G06F 8/38 (Continued)

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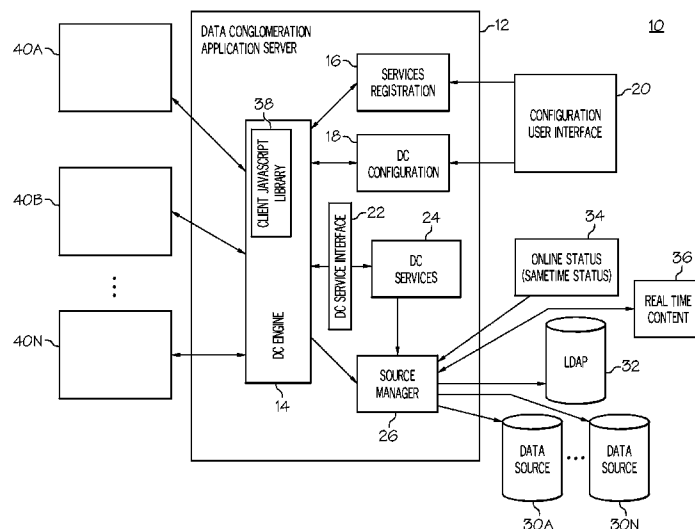
*Primary Examiner* — Anna Deng

(74) *Attorney, Agent, or Firm* — Maeve McCarthy; Hoffman Warnick LLC

(57) **ABSTRACT**

The present invention provides an approach and corresponding framework that separates data from its formatting/view by generating the dynamic JavaScript (data) as a set (e.g., at least one) of JavaScript (data) objects, without any HTML formatting. Then, a set of JavaScript functions can be created that takes the set of JavaScript objects as a parameter, and outputs all or a subset of this data object in a format determined by this JavaScript function. In general, these formatting functions can be static, rather than dynamic, JavaScript. This approach has the advantage of providing a much greater degree of formatting flexibility, without the need for each new format to establish a connection with the back-end system providing the data.

**5 Claims, 3 Drawing Sheets**





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**Related U.S. Application Data**

division of application No. 11/835,768, filed on Aug. 8, 2007, now Pat. No. 8,316,348.

(51) **Int. Cl.**

**G06F 9/455** (2006.01)

**H04L 29/06** (2006.01)

(58) **Field of Classification Search**

USPC ..... 717/110

See application file for complete search history.

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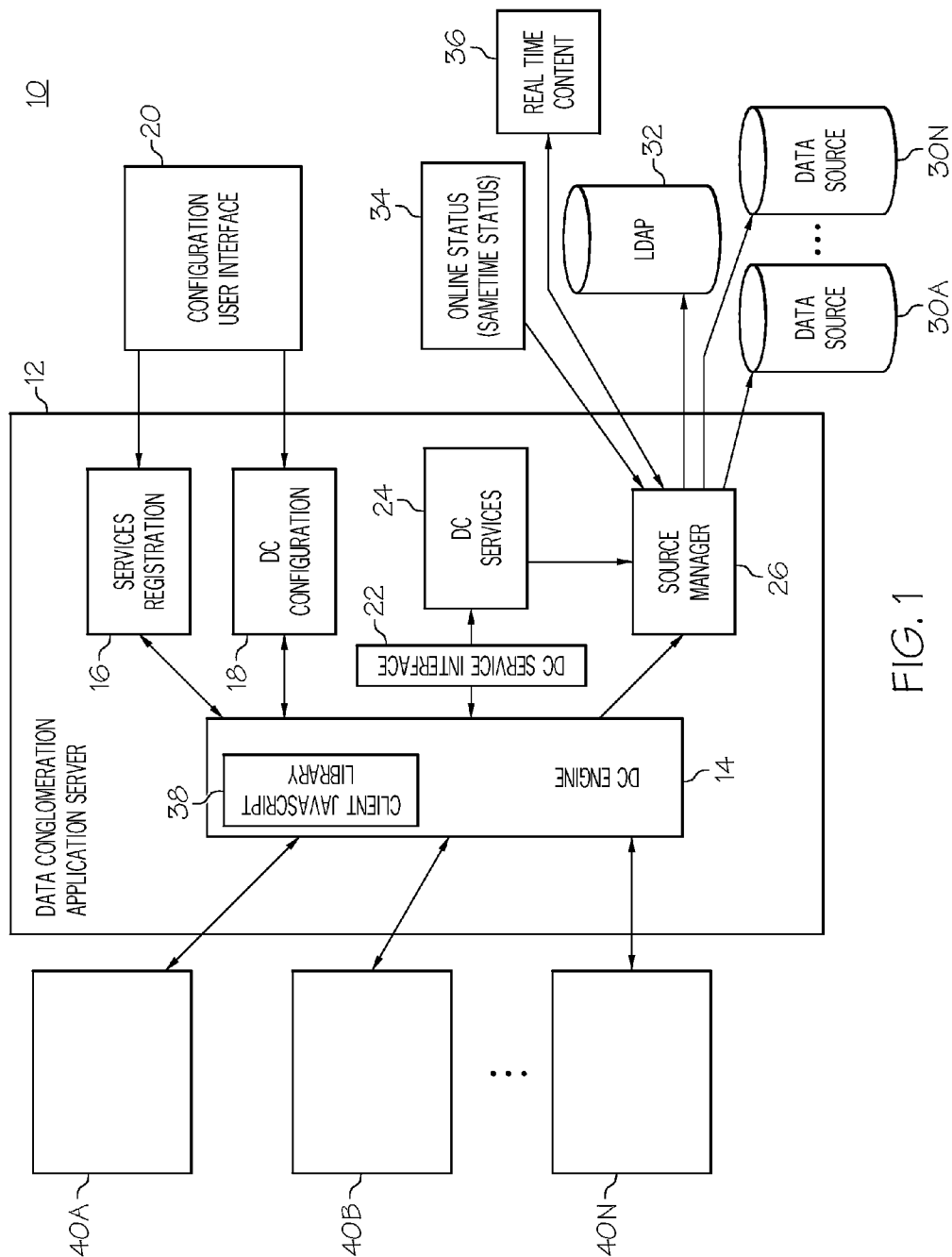


FIG. 1

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int id	String type	String address	float price	int bedrooms	float bathrooms	float lotsize	float size	boolean hasBasement	boolean finished	Date dateBuilt	Date dateAvailable	ValuesList rooms				
												String name	float size	int windows	String floor-type	String other- description
10201	Single Family Home	1001 Lucky Lake Drive, Kennesaw, Georgia 30152	499000	4	3.5	0.55	3200	true	false	Wed May 20 12:52:55 EDT 1998	Fri Aug 11 12:52:55 EDT 2006	Bedroom	250	2	carpet	walkin closet
												Bedroom	310	3	carpet	walkin closet
												Bedroom	1200	1	carpet	closet
												Bedroom	1180	1	carpet	closet
												Bathroom	150	1	granite tile	jet bathtub and shower
												Bathroom	120	1	granite tile	bathtub and shower
												Bathroom	100	0	ceramic tile	bathtub and shower
												Bathroom	180	1	vinyl	no shower
												Mediaroom	210	1	hardwood	bose system
												studyroom	112	1	hardwood	built-in bookshelf
10205	Town House	332 Cloud Drift Lane, Atlanta, Georgia 30002	159000	2	2	0.24	1180	false	false	Thu Oct 6 12:52:55 EDT 1998	Fri Jun 23 12:52:55 EDT 2006	Bedroom	210	1	carpet	walkin closet
												Bedroom	180	1	carpet	closet
												Bathroom	140	1	ceramic tile	bathtub and shower
												Bathroom	80	0	ceramic tile	NULL

FIG. 2

String	ValuesList			
description	items			
each individual row can contain different objects	NULL			
this row has two circles	String	float	float	
	type		radius	
	Circle		1.5	
	Circle		3.14	
this row has three ellipses	String	float	float	
	type	majoraxis	minoraxis	
	Ellipse	8	6	
	Ellipse	11.2	7	
this row has one rectangle	String	float	float	
	type	len	width	
	Rectangle	4.1	5.3	
	String	float	float	
this row has one triangles	String	float	float	
	type	side1	side2	side3
	Triangle	3	5	4
	Triangle	11	13	17

FIG. 3

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# METHOD, FRAMEWORK, AND PROGRAM PRODUCT FOR FORMATTING AND SERVING WEB CONTENT

## FIELD OF THE INVENTION

The present invention generally relates to formatting and serving of web content. Specifically, the present invention relates to the conglomeration, management and control of dynamic web content.

## BACKGROUND OF THE INVENTION

The use of a JavaScript library that contains dynamically generated content is a relatively new approach to embedding content on a web page. This approach has many labels, including JavaScript syndication and web content syndication. It also has several advantages. For example, because this approach requires no back-end integration, a web page developer simply embeds a URL to a JavaScript library and the dynamic content is added. This significantly reduces the complexities required to integrate third party content into a page. Because there is no back-end integration, there is no need to worry about software compatibility between the server generating the web page and the server generating the JavaScript library to embed the content. Also, there is no need for the web page developer to access an API to integrate the embedded content into the web page. The integration occurs when the page is rendered by the browser, not when the HTML is being generated on the web server.

Typically, the dynamically generated JavaScript library provides a function to embed its content of this library directly on the web page. Optionally, CSS (or similar technology) is used to adjust the 'look and feel' of the content to more closely match that of the included page. A disadvantage of this approach is that if the formatting provided by the JavaScript library does not provide the formatting desired for the including page, then a new dynamically generated JavaScript library must be created. This additional JavaScript library passes the same or similar content as the first JavaScript library, but formats the output in a different way. As more variations of this dynamically generated JavaScript library are created for various formats, maintaining updates across all variations can become difficult to maintain. Also, every additional dynamically generated JavaScript library must interface with whatever back-end system is providing the data.

In view of the foregoing, there exists a need for an approach that solves at least one of the deficiencies in the related art.

## SUMMARY OF THE INVENTION

In general, the present invention provides an approach and corresponding framework that separates data from its formatting/view by generating the dynamic JavaScript (data) as a set (e.g., at least one) of JavaScript (data) objects, without any HTML formatting. Then, a set of JavaScript functions can be created that takes the set of JavaScript objects as a parameter, and outputs all, or a subset, of this data object in a format determined by this JavaScript function. In general, these formatting functions can be static, rather than dynamic, JavaScript. This approach has the advantage of providing a much greater degree of formatting flexibility, without the need for each new format to establish a connection with the back-end system providing the data. This separation of data and format also allows for the

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possibility of the dynamically generated set of JavaScript objects to be obtained from one server while the set of JavaScript functions used for formatting be obtained from an entirely different server. In a typical embodiment, the set of JavaScript functions are written in a way that is compatible with the format of the dynamically generated set of JavaScript objects being passed as a parameter. As the data format changes, the HTML formatting JavaScript function can change too.

A first aspect of the present invention provides a method for formatting and serving web content, comprising: providing a set of JavaScript objects that represents dynamic JavaScript data; providing a set of JavaScript functions to format the set of JavaScript objects, the set of JavaScript objects being distinct from the set of JavaScript functions; and formatting the set of JavaScript objects using the set of JavaScript functions.

A second aspect of the present invention provides a framework for formatting and serving web content, comprising: a data conglomeration engine for receiving and processing data conglomeration requests, and for serving requested data conglomeration services; a services registration database for storing data conglomeration service metadata; a data conglomeration services module for maintaining a set of data conglomeration services, the data conglomeration services module interfacing with the data conglomeration engine via a data conglomeration services interface; a data conglomeration configuration repository for storing data conglomeration engine configurations and data conglomeration service configurations; and a source manager for interfacing with static and dynamic data sources that are accessed in response to the data conglomeration requests.

A third aspect of the present invention provides a program product stored on a computer readable medium for formatting and serving web content, the computer readable medium comprising program code for causing a computer system to: receive and process a data conglomeration request into a data conglomeration service call; obtain data in response to the data conglomeration service call; utilize a set of JavaScript objects to represent the data as JavaScript data; format the set of JavaScript objects using a set of JavaScript functions; and serve formatted JavaScript objects as web content to a caller issuing the data conglomeration request.

A fourth aspect of the present invention provides a method for deploying a system for formatting and serving web content, comprising: providing a computer infrastructure being operable to: receive and process a data conglomeration request into a data conglomeration service call; obtain data in response to the data conglomeration service call; utilize a set of JavaScript objects to represent the data as JavaScript data; format the set of JavaScript objects using a set of JavaScript functions; and serve formatted JavaScript objects as web content to a caller issuing the data conglomeration request.

A fifth aspect of the present invention provides a computer-implemented business method for formatting and serving web content, comprising: receiving and processing a data conglomeration request into a data conglomeration service call; obtaining data in response to the data conglomeration service call; utilizing a set of JavaScript objects to represent the data as JavaScript data; formatting the set of JavaScript objects using a set of JavaScript functions; and serving formatted JavaScript objects as web content to a caller issuing the data conglomeration request.

A sixth aspect of the present invention provides computer software embodied in a propagated signal for formatting and

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serving web content, the computer software comprising instructions for causing a computer system to: receive and process a data conglomeration request into a data conglomeration service call; obtain data in response to the data conglomeration service call; utilize a set of JavaScript objects to represent the data as JavaScript data; format the set of JavaScript objects using a set of JavaScript functions; and serve formatted JavaScript objects as web content to a caller issuing the data conglomeration request.

A seventh aspect of the present invention provides a data processing system for formatting and serving web content, comprising a memory medium having instructions, a bus coupled to the memory medium, and a processor coupled to the bus that when executing the instructions cause the data processing system to: receive and process a data conglomeration request into a data conglomeration service call; obtain data in response to the data conglomeration service call; utilize a set of JavaScript objects to represent the data as JavaScript data; format the set of JavaScript objects using a set of JavaScript functions; and serve formatted JavaScript objects as web content to a caller issuing the data conglomeration request.

#### BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of this invention will be more readily understood from the following detailed description of the various aspects of the invention taken in conjunction with the accompanying drawings in which:

FIG. 1 depicts an illustrative framework for formatting and serving web content according to the present invention.

FIG. 2 depicts an illustrative ValuesList on a web page according to the present invention.

FIG. 3 depicts illustrative data served on a web page according to the present invention.

The drawings are not necessarily to scale. The drawings are merely schematic representations, not intended to portray specific parameters of the invention. The drawings are intended to depict only typical embodiments of the invention, and therefore should not be considered as limiting the scope of the invention. In the drawings, like numbering represents like elements.

#### DETAILED DESCRIPTION OF THE INVENTION

For convenience, the Detailed Description of the Invention will have the following sections:

- I. General Description
- II. Expert and Knowledge Tracker
- III. Computerized Implementation

##### I. General Description

In general, the present invention provides an approach and corresponding framework that separates data from its formatting/view by generating the dynamic JavaScript (data) as a set (e.g., at least one) of JavaScript (data) objects, without any HTML formatting. Then, a set of JavaScript functions can be created that takes the set of JavaScript object as a parameter, and outputs all or a subset of this data object in a format determined by this JavaScript function. In general, these formatting functions can be static, rather than dynamic, JavaScript. This approach has the advantage of providing a much greater degree of formatting flexibility, without the need for each new format to establish a connection with the back-end system providing the data. This

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separation of data and format also allows for the possibility of the dynamically generated set of JavaScript objects to be obtained from one server while the set of JavaScript functions used for formatting be obtained from an entirely different server. In a typical embodiment, the set of JavaScript functions are written in a way that is compatible with the format of the dynamically generated set of JavaScript objects being passed as a parameter. As the data format changes, the HTML formatting JavaScript function can change too.

For clarity, the technique of combining data elements from different data sources into a single data content will be referred to herein as Data Conglomeration, or DC. In addition, the data format representing the DC content will be referred to herein as ValuesList. In any event, an aspect of this invention is to provide a framework to integrate DC Services to stream dynamic content from different data sources to any web site, and to update portions of the web page. In an illustrative embodiment, the data format of choice being used is ValuesList, which will be explained in detail. The technique used to dynamically refresh content is dynamic JavaScript reload and callback to process the data in JavaScript.

Some advantages of this invention are that: it allows a page to request dynamic content and automatic update portion of the page when the content is changed on a timely basis; it provides an interface to register installable services; it uses an innovative data structure (ValuesList) to map any server side data to web client; it provides an interface for user to dynamically pick and choose and configure the data elements from different data sources to be sent to the client; under the present invention, server side configuration changes will be reflected immediately on the next service call; it provides an interface or configuration file to setup different data sources; and, it provides a standard client JavaScript library to make server calls and parse and process the result data format.

Referring now to FIG. 1, a DC server framework according to the present invention is shown. It should be understood in advance that framework 10 can be implemented in a number of ways. All components could be implemented and deployed on a single application server such as DC application server 12. However, many or all of these components could also be implemented on entirely separate servers, connected via network interfaces.

In a typical embodiment, DC Server Framework 10 includes the following components:

**DC Engine 14:** A program responsible for serving requested DC services. DC Engine acts as a controller for incoming requests. It breaks down a request and translates requested methods and parameters into a matching DC Service call. If the caller is a web page, the resulting ValuesList is encoded as a JavaScript String, and sent back to the client. The calling web page may pass a callback JavaScript function name, that function will be called when the request is returned. If the caller is an application, the engine has the option to encode the resulting ValuesList into Web Service XML.

**Services Registration Database 16:** A database that stores the DC Service metadata (e.g., method name, parameters). Services can be added or removed from the registry. This allows people to find new services easily and develop new web pages or applications to utilize them.

**DC Configuration Repository 18:** A configuration repository that holds DC Engine configurations and DC Service configurations. DC Configuration Repository 18 is used by DC Engine 14 to gather additional parameters such as SQL



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statement, attribute list for LDAP, search criteria, and/or simple list of data elements for each DC Service. This allows the user to define in detail what data elements are included and how data elements are fetched from each data source for DC Service.

Configuration User Interface 20: A user interface to DC configuration repository 18 and Service Registration module 16. It can be used by DC Administrators to register new services and configure the service parameters and list of data elements.

DC Service Interface 22: An agreed interface between DC Engine 14 and DC Services module 24. All DC Services implement this interface. DC calls each service through this common interface. In this interface, the resulting data format returned to the caller is always the same. The data format is flexible enough to allow for easy addition and subtraction of data elements from different data sources. The data format is simple and mirrors a table representation but can grow in depth to handle more complexity.

DC Services module 24: A module that hold/maintains DC Services that are a set of services built according to DC Service Interface 22. Each DC Service is an installable component that can be installed through Configuration User Interface 20.

Source Manager 26: Source manager 26 maintains all static and dynamic data sources. It can also provide interfaces to databases 30A-N of preexisting web content, LDAPs 32, online statuses 34, real-time web content 36, etc.

Date Source 30: The data source such as database, LDAP, some real time content, user online status, etc.

Client Component 38: The client component comprises a JavaScript library that contains the JavaScript objects and JavaScript functions. Specifically, there are JavaScript functions to make a client call to server from any web page 40A-N. There are JavaScript functions to parse and process the resulting encoded String into common data format ValuesList. FIG. 2 depicts examples of real ValuesList showings on web pages. ValuesList is a table like presentation of data and one can view them as rows and columns. ValuesList has a column name and type to describe a column. The content can be stored as columns or rows. As depicted, the data types are all mapped to JavaScript primitive types and internal object types such as number (float), integer, String, Boolean, Date. One advantage of ValuesList is that its columns can contain ValuesList type thus giving it great ability to recursive down to complex data structures. Another example is shown in FIG. 3 that depicts illustrative data on a web page.

Using framework 10 of FIG. 1, the present invention provides a way to format and serve web content by: receiving and processing a data conglomeration request into a data conglomeration service call; obtaining data in response to the data conglomeration service call; utilizing a set of JavaScript objects to represent the data as JavaScript data; formatting the set of JavaScript objects using a set of JavaScript functions; and serving formatted JavaScript objects as web content to a caller issuing the data conglomeration request.

## II. Expert and Knowledge Tracker

The present invention also provides an Expert and Knowledge Tracker that is an application that allows users/learners to chat real-time with experts about questions that pertain directly to that expert's area of expertise, and it retains and shows questions that have already been asked and answered. The application has been written to best serve the expert (as

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well as the user/learner) to encourage experts to share their knowledge—with features that will engage the busiest experts and allow them to disseminate information in the fastest way and the fewest times possible. Below is the workflow from the expert's point of view:

Set "office hours" to appear as available to users/learners, using the expert's instant messaging status. There are four ways to achieve this (to accommodate different working styles). Note that options 1, 2, and 3 allow an expert to be using their instant messaging services but NOT appear as available to learners if desired:

1. Ad hoc—simply tell the Expert Tracker bot one is available "now" and then turn off this function when no longer available.
2. Calendar schedule—use calendar function in office software to set times when to be available. At those times, if the expert is logged into instant messaging, s/he will appear as available during those times.
3. Web schedule—use web function to set times when to be available. At those times, if the expert is logged into instant messaging, s/he will appear as available during those times.
4. Default to instant messaging—use the expert's instant messaging status to determine availability.

When a learner wants to chat, s/he sees the expert's actual availability (which is updated real-time). The learner and the expert receive an instant message asking them to join a session. The learner and expert chat. At the end of the chat session, both the learner and the expert receive a short questionnaire, asking for the perceived value of the chat, whether the chat can be stored for future use, and for any other comments either may have.

The expert receives periodical reports of how much time s/he has spent in chats, what the value has been, the content of saved chats, and any other comments supplied. The expert can therefore have an accurate record of his/her participation and the value of that participation to IBM.

The expert is able to review all chats and pick any to decide if s/he wants to turn the chat into a publishable FAQ. The question the learner asked is placed in the "Q" field and the rest of the chat session is placed in the "A" field. The expert may edit the Q and A as desired, and then hit "publish". The FAQ may be published anywhere, but at least on the page where the learner sees him/her available to chat, so that if the question the learner has matches an existing FAQ, the expert is not asked that question again.

## III. Computerized Implementation

It should be understood that any of the teachings of the present invention the present invention could be deployed on one or more computing devices (e.g., servers, clients, etc.) within a computer infrastructure. This is intended to demonstrate, among other things, that the present invention could be implemented within a network environment (e.g., the Internet, a wide area network (WAN), a local area network (LAN), a virtual private network (VPN), etc.), or on a stand-alone computer system. In the case of the former, communication throughout the network can occur via any combination of various types of communications links. For example, the communication links can comprise addressable connections that may utilize any combination of wired and/or wireless transmission methods. Where communications occur via the Internet, connectivity could be provided

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by conventional TCP/IP sockets-based protocol, and an Internet service provider could be used to establish connectivity to the Internet. Still yet, the computer infrastructure is intended to demonstrate that some or all of the components of such an implementation could be deployed, managed, serviced, etc. by a service provider who offers to implement, deploy, and/or perform the functions of the present invention for others.

Where computer hardware is provided, it is understood that such any computers utilized will include standard elements such as a processing unit, a memory medium, a bus coupling the memory medium to the bus, input/output (I/O) interfaces coupled to the bus, etc. Further, such computer system(s) can be in communication with external I/O devices/resources. In general, processing units execute computer program code such as one or more of the components depicted in FIG. 1 to provide the functionality described above, which is stored in memory medium(s). While executing computer program code, the processing unit can read and/or write data to/from memory, I/O interfaces, etc. The bus provides a communication link between each of the components in a computer. External devices can comprise any device (e.g., keyboard, pointing device, display, etc.) that enable a user to interact with the computer system and/or any devices (e.g., network card, modem, etc.) that enable the computer to communicate with one or more other computing devices.

The hardware used to implement the present invention can comprise any specific purpose computing article of manufacture comprising hardware and/or computer program code for performing specific functions, any computing article of manufacture that comprises a combination of specific purpose and general purpose hardware/software, or the like. In each case, the program code and hardware can be created using standard programming and engineering techniques, respectively. Moreover, the processing unit therein may comprise a single processing unit, or be distributed across one or more processing units in one or more locations, e.g., on a client and server. Similarly, the memory medium can comprise any combination of various types of data storage and/or transmission media that reside at one or more physical locations. Further, the I/O interfaces can comprise any system for exchanging information with one or more external device. Still further, it is understood that one or more additional components (e.g., system software, math co-processing unit, etc.) can be included in the hardware.

While shown and described herein as a method, framework, and program product for formatting and serving web content, it is understood that the invention further provides various alternative embodiments. For example, in one embodiment, the invention provides a computer-readable/useable medium that includes computer program code to enable a computer infrastructure to format and serve web content. To this extent, the computer-readable/useable medium includes program code that implements the process(es) of the invention. It is understood that the terms computer-readable medium or computer useable medium comprises one or more of any type of physical embodiment of the program code. In particular, the computer-readable/useable medium can comprise program code embodied on one or more portable storage articles of manufacture (e.g., a compact disc, a magnetic disk, a tape, etc.), on one or more data storage portions of a computing device (e.g., a fixed disk, a read-only memory, a random access memory, a cache memory, etc.), and/or as a data signal (e.g., a propagated

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signal) traveling over a network (e.g., during a wired/wireless electronic distribution of the program code).

In another embodiment, the invention provides a business method that performs the process of the invention on a subscription, advertising, and/or fee basis. That is, a service provider, such as a Solution Integrator, could offer to process images. In this case, the service provider can create, maintain, support, etc., a computer infrastructure, such as computer infrastructure that performs the process of the invention for one or more customers. In return, the service provider can receive payment from the customer(s) under a subscription and/or fee agreement and/or the service provider can receive payment from the sale of advertising content to one or more third parties.

In still another embodiment, the invention provides a computer-implemented method for serving and formatting web content. In this case, a computer infrastructure, such as a computer infrastructure can be provided and one or more systems for performing the process of the invention can be obtained (e.g., created, purchased, used, modified, etc.) and deployed to the computer infrastructure. To this extent, the deployment of a system can comprise one or more of: (1) installing program code on a computing device from a computer-readable medium; (2) adding one or more computing devices to the computer infrastructure; and (3) incorporating and/or modifying one or more existing systems of the computer infrastructure to enable the computer infrastructure to perform the process of the invention.

As used herein, it is understood that the terms “program code” and “computer program code” are synonymous and mean any expression, in any language, code or notation, of a set of instructions intended to cause a computing device having an information processing capability to perform a particular function either directly or after either or both of the following: (a) conversion to another language, code or notation; and/or (b) reproduction in a different material form. To this extent, program code can be embodied as one or more of: an application/software program, component software/a library of functions, an operating system, a basic I/O system/driver for a particular computing and/or I/O device, and the like.

A data processing system suitable for storing and/or executing program code can be provided hereunder and can include at least one processor communicatively coupled, directly or indirectly, to memory element(s) through a system bus. The memory elements can include, but are not limited to, local memory employed during actual execution of the program code, bulk storage, and cache memories that provide temporary storage of at least some program code in order to reduce the number of times code must be retrieved from bulk storage during execution. Input/output or I/O devices (including, but not limited to, keyboards, displays, pointing devices, etc.) can be coupled to the system either directly or through intervening I/O controllers.

Network adapters also may be coupled to the system to enable the data processing system to become coupled to other data processing systems, remote printers, storage devices, and/or the like, through any combination of intervening private or public networks. Illustrative network adapters include, but are not limited to, modems, cable modems and Ethernet cards.

The foregoing description of various aspects of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and obviously, many modifications and variations are possible. Such modifications and variations that may be apparent to a person skilled

US 9,569,414 B2

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in the art are intended to be included within the scope of the invention as defined by the accompanying claims.

We claim:

1. A method for formatting and serving web content, the method performed by a processor comprising:  
requesting a set of JavaScript objects and a set of JavaScript functions in a single Hypertext Transfer Protocol (HTTP) request; and  
in response to the requesting:  
obtaining the set of JavaScript objects that represents dynamic JavaScript data; and  
obtaining the set of JavaScript functions to format the set of JavaScript objects, the set of JavaScript objects being distinct from the set of JavaScript functions; and  
formatting the set of JavaScript objects using the set of JavaScript functions as a parameter; and

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outputting at least a subset of the set of JavaScript objects in a format determined by the set of JavaScript functions.  
2. The method of claim 1, the set of JavaScript objects and the set of JavaScript functions being contained in a common JavaScript library.  
3. The method of claim 2, the common JavaScript library being accessible by a data conglomeration engine, the data conglomeration engine serving the set of JavaScript objects.  
4. The method of claim 3, the common JavaScript library being for matched content streams and Hypertext Markup Language (HTML) skins.  
5. The method of claim 1, wherein the set of JavaScript objects is requested from and contained on a first server and the set of JavaScript functions is requested from and contained on a second server.

\* \* \* \* \*

# **EXHIBIT 9**



**DESMARAIS** LLP

# **Zillow Infringes U.S. Patent No. 9,569,414 (Lai)**

*Subject to Fed. R. Evid. 408*

# U.S. Patent No. 9,569,414 (Lai) - Overview

(12) <b>United States Patent</b> <b>Lai et al.</b>	(10) <b>Patent No.:</b> <b>US 9,569,414 B2</b> (45) <b>Date of Patent:</b> <b>*Feb. 14, 2017</b>
(54) <b>METHOD, FRAMEWORK, AND PROGRAM PRODUCT FOR FORMATTING AND SERVING WEB CONTENT</b>	(52) <b>U.S. CL.</b> CPC ..... <b>G06F 17/2247</b> (2013.01); <b>G06F 9/4443</b> (2013.01); <b>G06F 9/45529</b> (2013.01); <b>H04L 67/42</b> (2013.01)
(71) Applicant: <b>International Business Machines Corporation</b> , Armonk, NY (US)	(58) <b>Field of Classification Search</b> CPC G06F 17/2247; G06F 9/4443; G06F 9/45529; G06F 8/33; G06F 8/71; G06F 8/38 (Continued)
(72) Inventors: <b>Jennifer Lai</b> , Garrison, NY (US); <b>Zhiqiang Liu</b> , Duluth, GA (US); <b>Brian J. McDonald</b> , Minneapolis, MN (US); <b>Laurie Miller</b> , Lyons, CO (US); <b>Yael Ravin</b> , Mount Kisco, NY (US); <b>Karen A. Ughetta</b> , Salem, VA (US)	(56) <b>References Cited</b>  U.S. PATENT DOCUMENTS  6,189,137 B1 2/2001 Hoffman 6,620,204 B1 9/2003 Malcolm (Continued)
(73) Assignee: <b>International Business Machines Corporation</b> , Armonk, NY (US)	OTHER PUBLICATIONS  Pham, Office Action Communication for U.S. Appl. No. 11/835,768 dated Mar. 13, 2012, 18 pages. (Continued)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.  This patent is subject to a terminal disclaimer.	<i>Primary Examiner</i> — Anna Deng (74) <i>Attorney, Agent, or Firm</i> — Maeve McCarthy; Hoffman Warnick LLC
(21) Appl. No.: <b>14/602,460</b>	(57) <b>ABSTRACT</b> The present invention provides an approach and corresponding framework that separates data from its formatting/view by generating the dynamic JavaScript (data) as a set (e.g., at least one) of JavaScript (data) objects, without any HTML formatting. Then, a set of JavaScript functions can be created that takes the set of JavaScript objects as a parameter, and outputs all or a subset of this data object in a format determined by this JavaScript function. In general, these formatting functions can be static, rather than dynamic, JavaScript. This approach has the advantage of providing a much greater degree of formatting flexibility without the
(22) Filed: <b>Jan. 22, 2015</b>	
(65) <b>Prior Publication Data</b>  US 2015/0134736 A1 May 14, 2015	
<b>Related U.S. Application Data</b>	
(60) Continuation of application No. 13/571,003, filed on Aug. 9, 2012, now Pat. No. 8,972,932, which is a division of application No. 11/835,768, filed on Aug. 8, 2007, now Pat. No. 8,316,348.	



## **U.S. Patent No. 9,569,414 (Lai) – Claim 1**

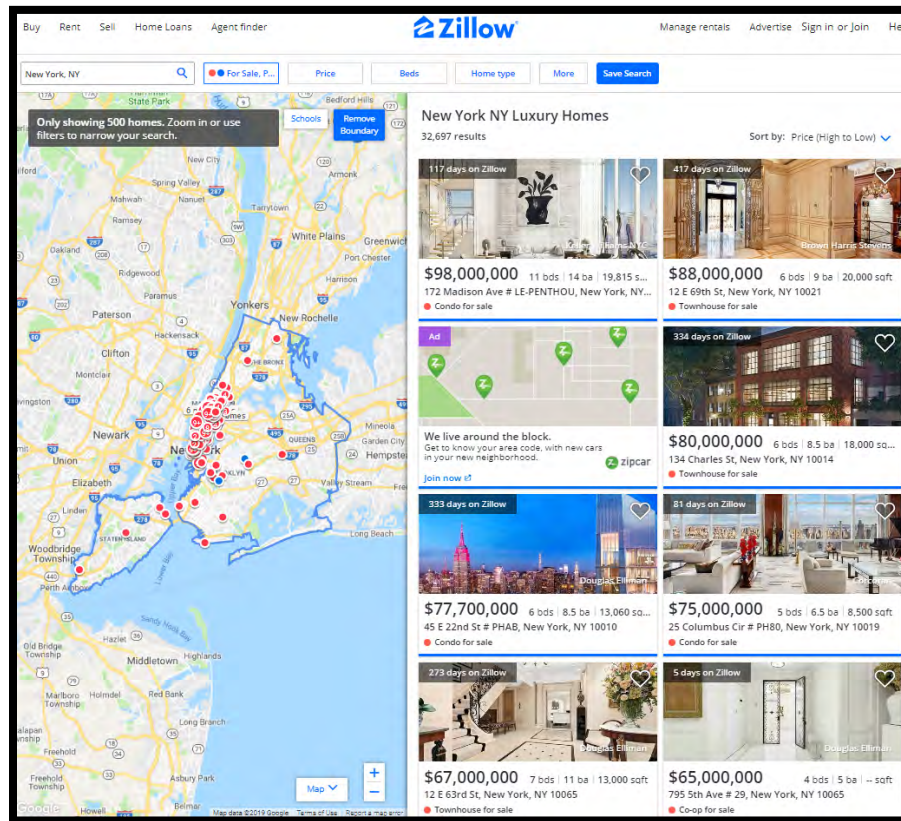
---

- 1. A method for formatting and serving web content, the method performed by a processor comprising:**
  - requesting a set of JavaScript objects and a set of JavaScript functions in a single Hypertext Transfer Protocol (HTTP) request; and**
  - in response to the requesting:**
    - obtaining the set of JavaScript objects that represents dynamic JavaScript data; and**
    - obtaining the set of JavaScript functions to format the set of JavaScript objects, the set of JavaScript objects being distinct from the set of JavaScript functions; and**
  - formatting the set of JavaScript objects using the set of JavaScript functions as a parameter; and**
  - outputting at least a subset of the set of JavaScript objects in a format determined by the set of JavaScript functions.**

# U.S. Patent No. 9,569,414 (Lai) – Claim 1

## 1. A method for formatting and serving web content, the method performed by a processor comprising:

**IBM Note:** After a search is performed on Zillow's website, Zillow formats the web content responsive to the search and serves the formatted content to the web browser.

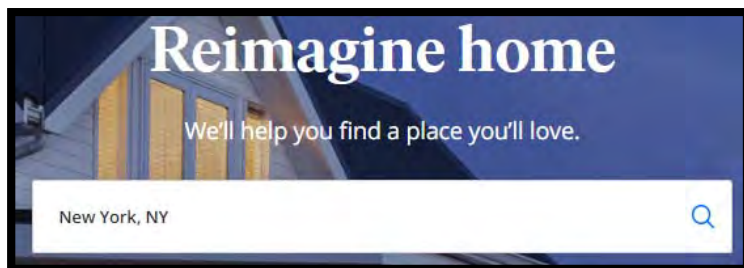


Zillow Search Results,  
[https://www.zillow.com/homes/New-York,-NY\\_rb/](https://www.zillow.com/homes/New-York,-NY_rb/)

## U.S. Patent No. 9,569,414 (Lai) – Claim 1

**(a) requesting a set of JavaScript objects and a set of JavaScript functions in a single Hypertext Transfer Protocol (HTTP) request; and**

**IBM Note:** After a user initiates a search, an HTTP request from the browser is received by an intermediate server, which then sends the request to a Zillow server to generate the search results. To generate the results, JavaScript objects and functions are obtained.



Zillow, <https://www.zillow.com>.



HTTP Request, Zillow Search Results,  
[https://www.zillow.com/homes/New-York,-NY\\_rb/](https://www.zillow.com/homes/New-York,-NY_rb/)



Intermediate Server



Zillow Server

# U.S. Patent No. 9,569,414 (Lai) – Claim 1

(b) in response to the requesting: obtaining the set of JavaScript objects that represents dynamic JavaScript data; and

**IBM Note:** In response to the HTTP request, Zillow's server obtains a set of JSON objects that represent the property listings responsive to the user's search query. The JSON objects are dynamic JavaScript data because they each represent a property search result in which various attributes, such as "price" and "statusType," may change.



Zillow Server

```

{
  "searchResults": {
    "listResults": [
      {
        "zpid": "2084024038",
        "id": "2084024038",
        "price": 98000000,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "31533674",
        "id": "31533674",
        "price": 143148526,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2083505536",
        "id": "2083505536",
        "price": 2083038641,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2089424678",
        "id": "2089424678",
        "price": 2089060341,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2082528807",
        "id": "2082528807",
        "price": 2082528807,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2136232752",
        "id": "2136232752",
        "price": 2136232752,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "97516205",
        "id": "97516205",
        "price": 97516205,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2087724598",
        "id": "2087724598",
        "price": 2087724598,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2082674949",
        "id": "2082674949",
        "price": 2082674949,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2082559362",
        "id": "2082559362",
        "price": 2082559362,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "219692413",
        "id": "219692413",
        "price": 219692413,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "244693275",
        "id": "244693275",
        "price": 244693275,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2083155303",
        "id": "2083155303",
        "price": 2083155303,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2084565487",
        "id": "2084565487",
        "price": 2084565487,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2085140825",
        "id": "2085140825",
        "price": 2085140825,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2094796306",
        "id": "2094796306",
        "price": 2094796306,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2086865460",
        "id": "2086865460",
        "price": 2086865460,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2087101986",
        "id": "2087101986",
        "price": 2087101986,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "244780373",
        "id": "244780373",
        "price": 244780373,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "31540851",
        "id": "31540851",
        "price": 31540851,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "143148526",
        "id": "143148526",
        "price": 143148526,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2083038641",
        "id": "2083038641",
        "price": 2083038641,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "2089060341",
        "id": "2089060341",
        "price": 2089060341,
        "statusType": "FOR SALE"
      },
      {
        "zpid": "244858599",
        "id": "244858599",
        "price": 244858599,
        "statusType": "FOR SALE"
      }
    ]
  }
}

```

JSON, Zillow Search Results,  
<https://www.zillow.com/search/GetSearchPageState.htm?searchQueryState=...>

```

{
  "zpid": "2084024038",
  "id": "2084024038",
  "address": "172 Madison Ave # LE-PENTHOU, New York, NY",
  "addressState": "NY",
  "addressWithZip": "172 Madison Ave # LE-PENTHOU, New York, NY 10016",
  "area": 19815,
  "baths": 14,
  "beds": 11,
  "brokerName": "Keller Williams NYC",
  "brokerPhone": "(646) 717-3990",
  "builderName": null,
  "commute": null,
  "countryCurrency": "$",
  "detailUrl": "https://www.zillow.com/homedetails/172-Madison-Ave-LE-PENTHOU-New-York-NY-10016/2084024038_zpid/",
  "estimate": null,
  "hdpData": {
    "isReactHomeDetails": true,
    "id": "2084024038"
  },
  "imgSrc": "https://photos.zillowstatic.com/p_e/ISy7cekpryktq1000000000.jpg",
  "isCurrentUserClaimedPropertyOwner": false,
  "isPreForeclosureCamo": false,
  "isSaved": false,
  "isUserClaimingOwner": false,
  "isZillowOwned": false,
  "latLong": {
    "latitude": 40.747299,
    "longitude": -73.983596
  },
  "list": true,
  "paymentPeriod": null,
  "pgapt": "ForSale",
  "photoCount": 9,
  "price": 98000000,
  "pricePerSqft": null,
  "relaxed": false,
  "sgapt": "For Sale (Broker)",
  "statusText": "Condo for sale",
  "statusType": "FOR SALE"
}

```

price: "\$98,000,000"

statusType: "FOR SALE"

# U.S. Patent No. 9,569,414 (Lai) – Claim 1

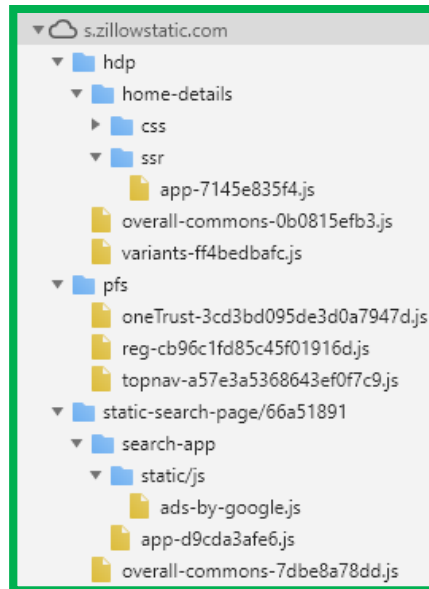
(c) obtaining the set of JavaScript functions to format the set of JavaScript objects, the set of JavaScript objects being distinct from the set of JavaScript functions; and

**IBM Note:** In response to the HTTP request, Zillow obtains a set of JavaScript files, each containing a set of JavaScript functions.



Zillow Server

s.zillowstatic.com, JavaScript files,  
Zillow Search Results,  
[https://www.zillow.com/homes/New-York,-NY\\_rb/](https://www.zillow.com/homes/New-York,-NY_rb/)



```

searchResults: {listResults: [{zpid: "2084024038", id: "2084024038",...}, {zpid: "31533674", id: "31533674",...},...]}
hasListResults: true
hasMapResults: true
listResults: [{zpid: "2084024038", id: "2084024038",...}, {zpid: "31533674", id: "31533674",...},...]}
0: {zpid: "2084024038", id: "2084024038",...}
1: {zpid: "31533674", id: "31533674",...}
2: {zpid: "2083505536", id: "2083505536",...}
3: {zpid: "2089424678", id: "2089424678",...}
4: {zpid: "2082528807", id: "2082528807",...}
5: {zpid: "2136232752", id: "2136232752",...}
6: {zpid: "97516205", id: "97516205",...}
7: {zpid: "2087724598", id: "2087724598",...}
8: {zpid: "2082674949", id: "2082674949",...}
9: {zpid: "2082559362", id: "2082559362",...}
10: {zpid: "219692413", id: "219692413",...}
11: {zpid: "244693275", id: "244693275",...}
12: {zpid: "2083155303", id: "2083155303",...}
13: {zpid: "2084565487", id: "2084565487",...}
14: {zpid: "2085140825", id: "2085140825",...}
15: {zpid: "2094796306", id: "2094796306",...}
16: {zpid: "2086865460", id: "2086865460",...}
17: {zpid: "2087101986", id: "2087101986",...}
18: {zpid: "244780373", id: "244780373",...}
19: {zpid: "31540851", id: "31540851",...}
20: {zpid: "143148526", id: "143148526",...}
21: {zpid: "2083038641", id: "2083038641",...}
22: {zpid: "2089060341", id: "2089060341",...}
23: {zpid: "244858599", id: "244858599",...}

```

JSON, Zillow Search Results,  
[https://www.zillow.com/search/GetSearchPageState.htm?searchQueryState= ...](https://www.zillow.com/search/GetSearchPageState.htm?searchQueryState=...)



# U.S. Patent No. 9,569,414 (Lai) – Claim 1

(d) formatting the set of JavaScript objects using the set of JavaScript functions as a parameter; and

**IBM Note:** The app-d9cda3afe6.js file formats the JSON objects by using JavaScript functions.

```
var sn, un, ln = function(e) {
  return Ge()(e, "searchPageConstants.isMobile", !0)
}, cn = function(e) {
  return !(("savedHomes" !== Ge()(e, "queryState.dataSource")))
}, fn = function(e) {
  return e && e.abTrials && ("TEST4" === e.abTrials.RE_RentalsHomesForYouSort || "TEST5"
), pn = function(e) {
  return Ge()(e, "baseUrl", "/homes/")
}, dn = function(e) {
  return Ge()(e, "uiState.numListColumns", 0)
}, hn = function(e, n) {
  for (var r = arguments.length, o = new Array(2 < r ? r - 2 : 0), i = 2; i < r; i++)
    o[i - 2] = arguments[i];
  return n ? Ge()(t, n, e.array(void 0, [t].concat(o))) : void 0
}, yn = function(e) {
  return hn(e.searchResults, "results", "listResults")
}, mn = function(e) {
  return Ge()(e, "searchResults.resultsHash")
}, gn = function(e) {
  return yn(e) || [].filter(function(e) {
    return !e.units
  }).map(function(e) {
    return e.zpid
  })
}, bn = function(e) {
  return Ge()(e, "searchResults.relaxedResults")
}, vn = function(e) {
  return Ge()(e, "searchResults.hasListResults")
}, Sn = function(e) {
  return Ge()(e, "searchResults.hasMapResults")
}, wn = function(e) {
  return e.searchResults && (e.searchResults.results ? "results" : "listResults")
}, En = function(e) {
  return hn(e.searchResults, "results", "mapResults")
}
```

```
searchResults: {listResults: [{zpid: "2084024038", id: "2084024038",...}, {zpid: "31533674", id: "31533674",...},...],...}
hasListResults: true
hasMapResults: true
▼ listResults: [{zpid: "2084024038", id: "2084024038",...}, {zpid: "31533674", id: "31533674",...},...],...}
  ▶ 0: {zpid: "2084024038", id: "2084024038",...}
  ▶ 1: {zpid: "31533674", id: "31533674",...}
  ▶ 2: {zpid: "2083505536", id: "2083505536",...}
  ▶ 3: {zpid: "2099424678", id: "2099424678",...}
  ▶ 4: {zpid: "2082528807", id: "2082528807",...}
  ▶ 5: {zpid: "2136232752", id: "2136232752",...}
  ▶ 6: {zpid: "97516205", id: "97516205",...}
  ▶ 7: {zpid: "2087724598", id: "2087724598",...}
  ▶ 8: {zpid: "2082674949", id: "2082674949",...}
  ▶ 9: {zpid: "2082559362", id: "2082559362",...}
  ▶ 10: {zpid: "219692413", id: "219692413",...}
  ▶ 11: {zpid: "244693275", id: "244693275",...}
  ▶ 12: {zpid: "2083155303", id: "2083155303",...}
  ▶ 13: {zpid: "2084565487", id: "2084565487",...}
  ▶ 14: {zpid: "2085140825", id: "2085140825",...}
  ▶ 15: {zpid: "2094796306", id: "2094796306",...}
  ▶ 16: {zpid: "2086865460", id: "2086865460",...}
  ▶ 17: {zpid: "2087101986", id: "2087101986",...}
  ▶ 18: {zpid: "244780373", id: "244780373",...}
  ▶ 19: {zpid: "31540851", id: "31540851",...}
  ▶ 20: {zpid: "143148526", id: "143148526",...}
  ▶ 21: {zpid: "2083038641", id: "2083038641",...}
  ▶ 22: {zpid: "2089060341", id: "2089060341",...}
  ▶ 23: {zpid: "244858599", id: "244858599",...}
```

JSON, Zillow Search Results,  
[https://www.zillow.com/search/GetSearchPageState.htm?searchQueryState= ...](https://www.zillow.com/search/GetSearchPageState.htm?searchQueryState=...)

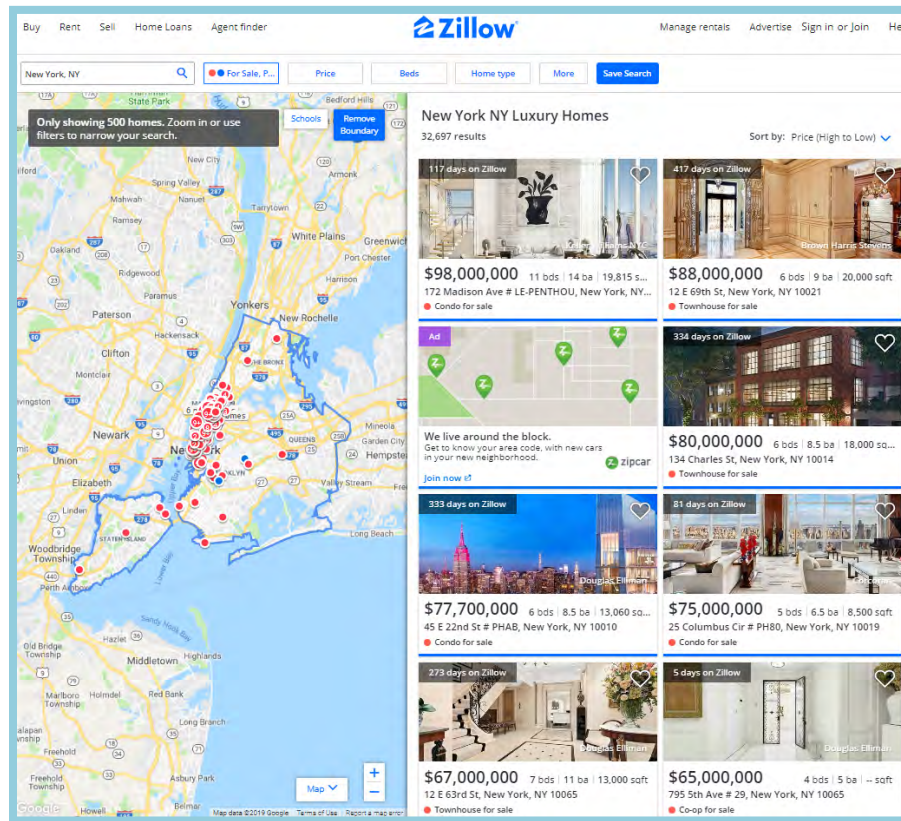
app-d9cda3afe6.js, Zillow Search Results,  
[https://www.zillow.com/homes/New-York,-NY\\_rb/](https://www.zillow.com/homes/New-York,-NY_rb/)



# U.S. Patent No. 9,569,414 (Lai) – Claim 1

(e) outputting at least a subset of the set of JavaScript objects in a format determined by the set of JavaScript functions.

**IBM Note:** Zillow outputs the search results page in the format determined by the JavaScript functions.



Zillow Search Results,  
[https://www.zillow.com/homes/New-York,-NY\\_rb/](https://www.zillow.com/homes/New-York,-NY_rb/)

# **EXHIBIT 10**

(12) **United States Patent**  
**Arroyo et al.**

(10) **Patent No.:** **US 10,115,168 B2**

(45) **Date of Patent:** **Oct. 30, 2018**

(54) **INTEGRATING METADATA FROM APPLICATIONS USED FOR SOCIAL NETWORKING INTO A CUSTOMER RELATIONSHIP MANAGEMENT (CRM) SYSTEM**

USPC ..... 707/741, 803  
See application file for complete search history.

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				705/7.32
8,731,918 B2 *	5/2014	Wasserblat	.....	G10L 15/26
				704/231
2007/0100739 A1 *	5/2007	Cui	.....	G06Q 30/08
				705/37
2008/0147478 A1 *	6/2008	Mall	.....	G06Q 30/02
				705/14.4
2008/0301549 A1 *	12/2008	Czudak	.....	G06F 17/30265
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				707/776

(Continued)

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(74) *Attorney, Agent, or Firm* — Fabian VanCott; Steven L. Nichols

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(72) Inventors: **Jorge A. Arroyo**, Carmel, IN (US);  
**Stephen P. Kruger**, Dublin (IE);  
**Luciano Silva**, Apex, NC (US); **Patrick J. O'Sullivan**, Dublin (IE)

(73) Assignee: **INTERNATIONAL BUSINESS MACHINES CORPORATION**, Armonk, NY (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 758 days.

(21) Appl. No.: **14/639,537**

(22) Filed: **Mar. 5, 2015**

(65) **Prior Publication Data**

US 2015/0332289 A1 Nov. 19, 2015

**Related U.S. Application Data**

(63) Continuation of application No. 14/281,042, filed on May 19, 2014, now Pat. No. 9,626,727.

(51) **Int. Cl.**  
**G06F 17/30** (2006.01)  
**G06Q 50/00** (2012.01)  
**G06Q 30/02** (2012.01)

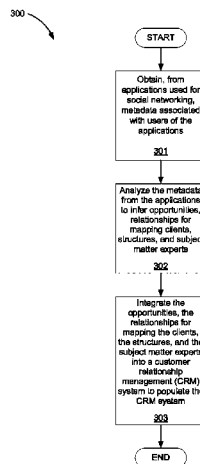
(52) **U.S. Cl.**  
CPC ..... **G06Q 50/01** (2013.01); **G06Q 30/0201** (2013.01)

(58) **Field of Classification Search**  
CPC ..... G06C 50/01; G06C 30/0201

(57) **ABSTRACT**

Integrating metadata from applications used for social networking into a customer relationship management (CRM) system includes obtaining, from applications used for social networking, metadata associated with users of the applications, analyzing the metadata from the applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts, and integrating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a CRM system to populate the CRM system.

**9 Claims, 5 Drawing Sheets**



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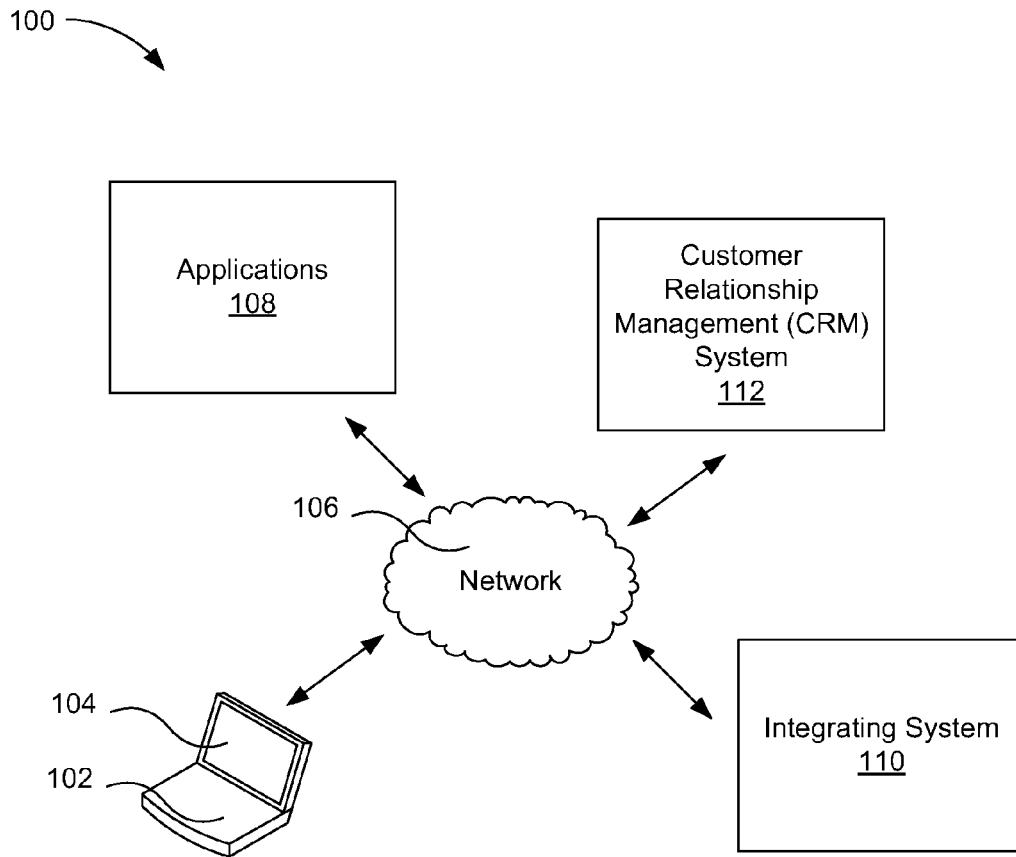
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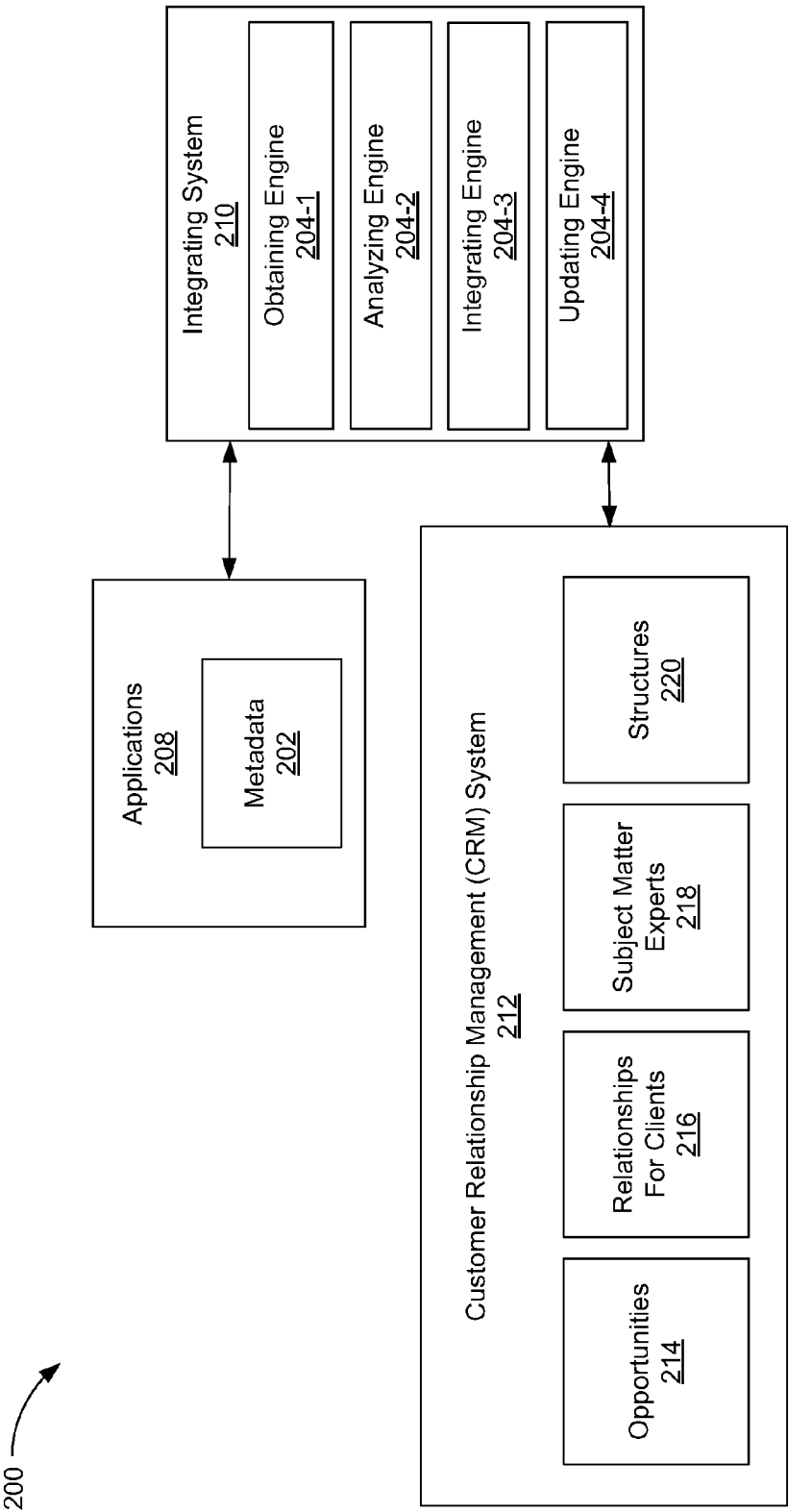
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**Fig. 1**



**Fig. 2**

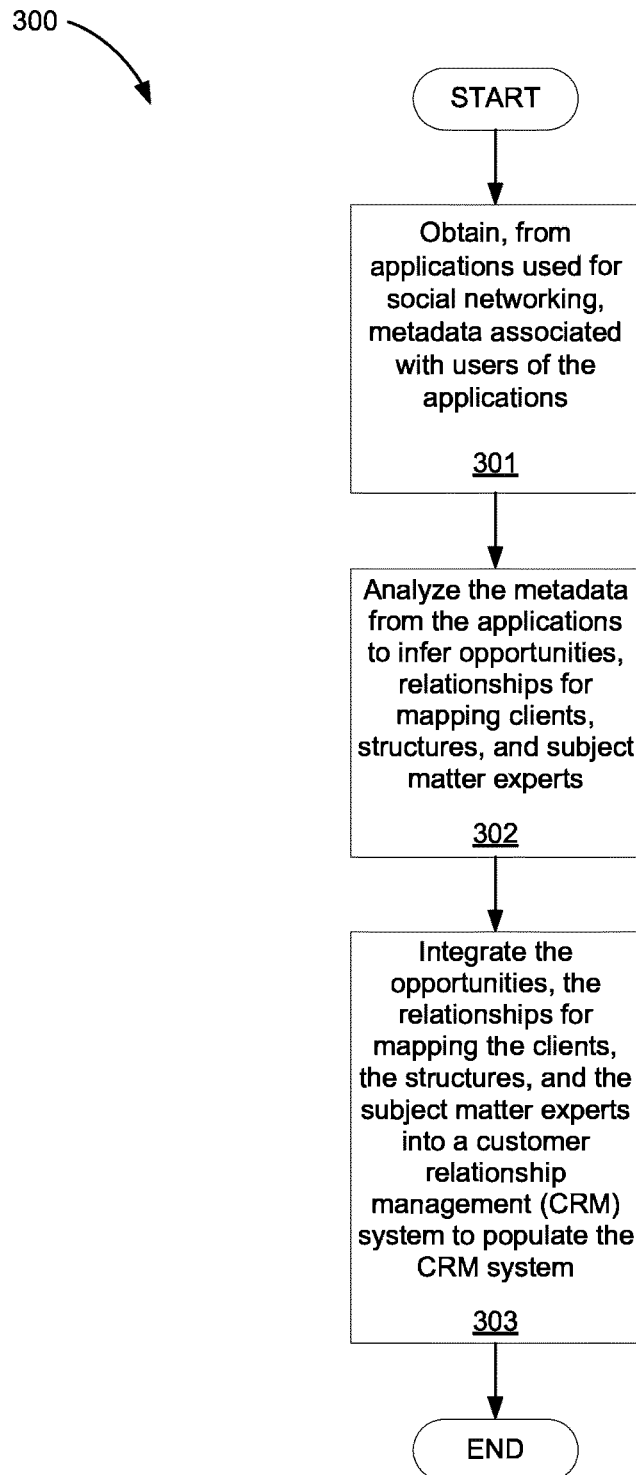


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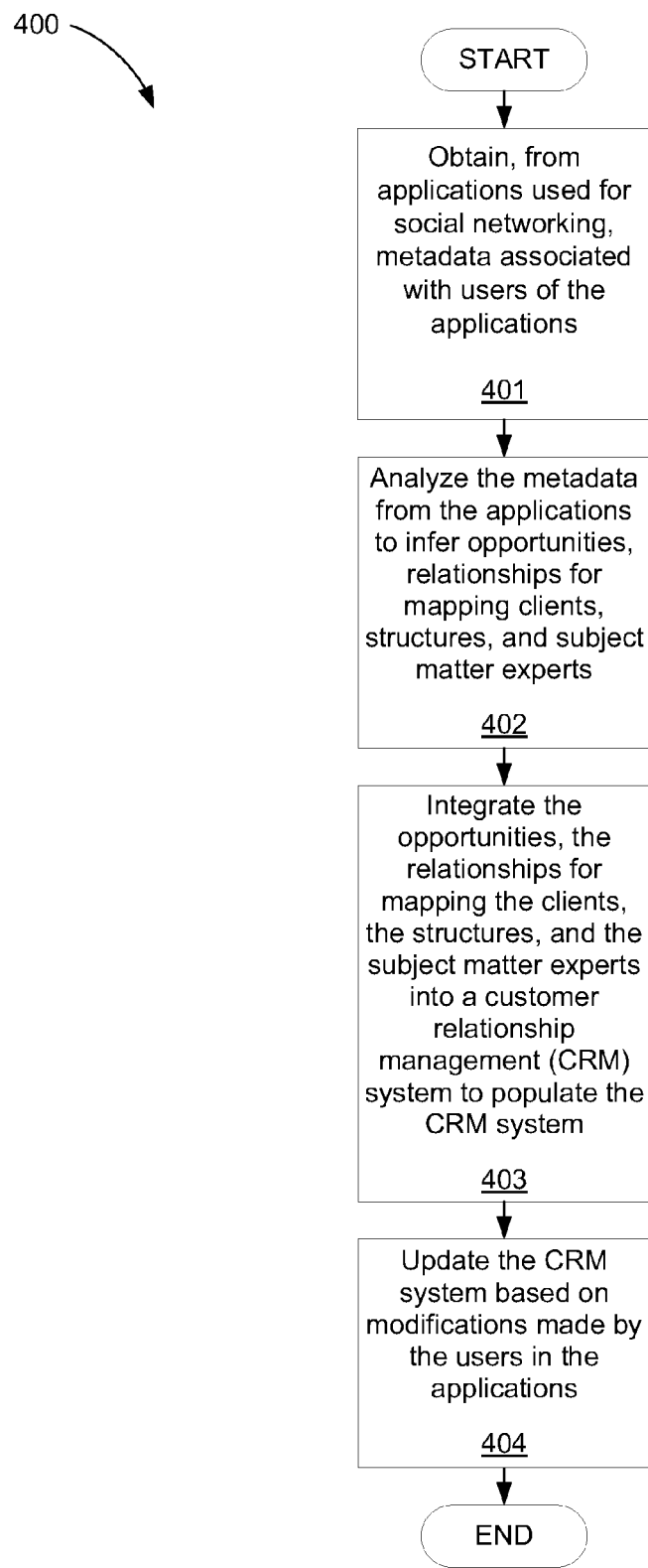
**Fig. 3**

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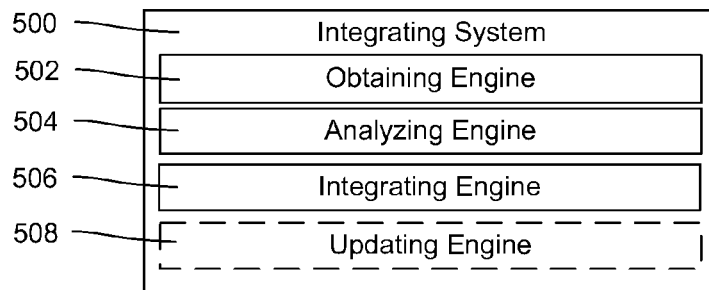
**Fig. 4**

U.S. Patent

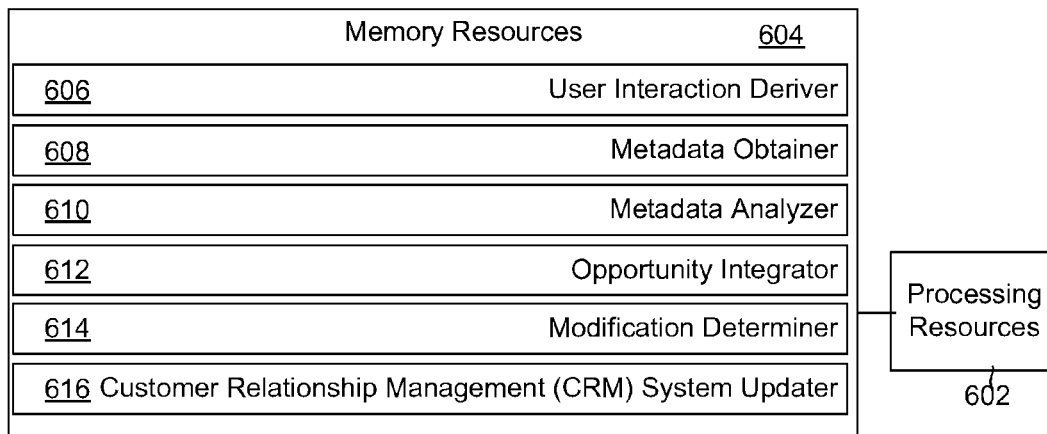
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**Fig. 5**

600

**Fig. 6**

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# **INTEGRATING METADATA FROM APPLICATIONS USED FOR SOCIAL NETWORKING INTO A CUSTOMER RELATIONSHIP MANAGEMENT (CRM) SYSTEM**

## BACKGROUND

The present invention relates to integrating metadata into a customer relationship management (CRM) system, and more specifically, to integrating metadata from applications used for social networking into a CRM system.

A CRM system uses techniques and methods to gather, organize, automate, and synchronize sales, for marketing, customer service, and technical support. This information is stored in the CRM system's memory. Further, this information is retrieved from the CRM system's memory and analyzed to allow a company to better target various customers.

## BRIEF SUMMARY

A method for integrating metadata from applications used for social networking into a customer relationship management (CRM) system includes obtaining, from applications used for social networking, metadata associated with users of the applications, analyzing the metadata from the applications to infer opportunities relationships for mapping clients, structures, and subject matter experts, and integrating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into CRM system to populate the CRM system.

A system for integrating metadata from applications used for social networking into a CRM system includes an obtaining engine to obtain, from applications used for social networking, metadata associated with users of the applications, an analyzing engine to analyze the metadata from the applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts, an integrating engine to integrate the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a CRM system to populate the CRM system, and an updating engine to update the CRM system based on modifications made by the users in the applications.

A computer program product includes a computer readable storage medium, the computer readable storage medium having computer readable program code embodied therewith. The computer readable program code having computer readable program code to analyze metadata from applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts, integrate the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a CRM system to populate the CRM system, and update the CRM system based on modifications made by the users in the applications.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The accompanying drawings illustrate various examples of the principles described herein and are a part of the specification. The examples do not limit the scope of the claims.

FIG. 1 is a diagram of an example of a system for integrating metadata from applications used for social net-

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working into a customer relationship management (CRM) system, according to one example of principles described herein.

FIG. 2 is a diagram of an example of a system for integrating metadata from applications used for social networking into a CRM system, according to one example of principles described herein.

FIG. 3 is a flowchart of an example of a method for integrating metadata from applications used for social networking into a CRM system, according to one example of principles described herein.

FIG. 4 is a flowchart of an example of a method for integrating metadata from applications used for social networking into a CRM system, according to one example of principles described herein.

FIG. 5 is a diagram of an example of an integrating system, according to the principles described herein.

FIG. 6 is a diagram of an example of an integrating system, according to the principles described herein.

Throughout the drawings, identical reference numbers designate similar, but not necessarily identical, elements.

## DETAILED DESCRIPTION

The present specification describes a method and system for integrating metadata from applications used for social networking into a customer relationship management (CRM) system, such that the CRM system is quickly populated with metadata from the applications.

The present invention may be a system, a method, and/or a computer program product. The computer program product may include a computer readable storage medium (or media) having computer readable program instructions thereon for causing a processor to carry out aspects of the present invention.

The computer readable storage medium can be a tangible device that can retain and store instructions for use by an instruction execution device. The computer readable storage medium may be, for example, but is not limited to, an electronic storage device, a magnetic storage device, an optical storage device, an electromagnetic storage device, a semiconductor storage device, or any suitable combination of the foregoing. A non-exhaustive list of more specific examples of the computer readable storage medium includes the following: a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), a static random access memory (SRAM), a portable compact disc read-only memory (CD-ROM), a digital versatile disk (DVD), a memory stick, a floppy disk, a mechanically encoded device such as punch-cards or raised structures in a groove having instructions recorded thereon, and any suitable combination of the foregoing. A computer readable storage medium, as used herein, is not to be construed as being transitory signals per se, such as radio waves or other freely propagating electromagnetic waves, electromagnetic waves propagating through a waveguide or other transmission media (e.g., light pulses passing through a fiber-optic cable), or electrical signals transmitted through a wire.

Computer readable program instructions described herein can be downloaded to respective computing/processing devices from a computer readable storage medium or to an external computer or external storage device via a network, for example, the Internet, a local area network, a wide area network and/or a wireless network. The network may comprise copper transmission cables, optical transmission fibers,

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wireless transmission, routers, firewalls, switches, gateway computers and/or edge servers. A network adapter card or network interface in each computing/processing device receives computer readable program instructions from the network and forwards the computer readable program instructions for storage in a computer readable storage medium within the respective computing/processing device.

Computer readable program instructions for carrying out operations of the present invention may be assembler instructions, instruction-set-architecture (ISA) instructions, machine instructions, machine dependent instructions, microcode, firmware instructions, state-setting data, or either source code or object code written in any combination of one or more programming languages, including an object oriented programming language such as Smalltalk, C++ or the like, and conventional procedural programming languages, such as the “C” programming language or similar programming languages. The computer readable program instructions may execute entirely on the user’s computer, partly on the user’s computer, as a stand-alone software package, partly on the user’s computer and partly on a remote computer or entirely on the remote computer or server. In the latter scenario, the remote computer may be connected to the user’s computer through any type of network, including a local area network (LAN) or a wide area network (WAN), or the connection may be made to an external computer (for example, through the Internet using an Internet Service Provider). In some embodiments, electronic circuitry including, for example, programmable logic circuitry, field-programmable gate arrays (FPGA), or programmable logic arrays (PLA) may execute the computer readable program instructions by utilizing state information of the computer readable program instructions to personalize the electronic circuitry, in order to perform aspects of the present invention.

Aspects of the present invention are described herein with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems), and computer program products according to embodiments of the invention. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer readable program instructions.

These computer readable program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks. These computer readable program instructions may also be stored in a computer readable storage medium that can direct a computer, a programmable data processing apparatus, and/or other devices to function in a particular manner, such that the computer readable storage medium having instructions stored therein comprises an article of manufacture including instructions which implement aspects of the function/act specified in the flowchart and/or block diagram block or blocks.

The computer readable program instructions may also be loaded onto a computer, other programmable data processing apparatus, or other device to cause a series of operational steps to be performed on the computer, other programmable apparatus or other device to produce a computer implemented process, such that the instructions which execute on the computer, other programmable apparatus, or other

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device implement the functions/acts specified in the flowchart and/or block diagram block or blocks.

The flowchart and block diagrams in the Figures illustrate the architecture, functionality, and operation of possible implementations of systems, methods, and computer program products according to various embodiments of the present invention. In this regard, each block in the flowchart or block diagrams may represent a module, segment, or portion of instructions, which comprises one or more executable instructions for implementing the specified logical function(s). In some alternative implementations, the functions noted in the block may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. It will also be noted that each block of the block diagrams and/or flowchart illustration, and combinations of blocks in the block diagrams and/or flowchart illustration, can be implemented by special purpose hardware-based systems that perform the specified functions or acts or carry out combinations of special purpose hardware and computer instructions.

As noted above, the CRM system uses techniques and methods to organize, automate, and synchronize sales, for marketing, customer service, and technical support. This information that the CRM system gathers is stored in the CRM system’s memory. Further, this information may be categorized as opportunities in the CRM system’s memory. A user associated with a company may view the opportunities gather by the CRM system to allow the company to better target various customers.

Often, new CRM systems lack any rich data or relationships that are associated with this information. Over time the new CRM systems are populated with rich data or relationships that are associated with this information. However, the time needed to populate the new CRM system with rich data or relationships may be significant. As a result, a new CRM system may not be effective in targeting various customers for quite some time.

The principles described herein include a system and a method for integrating metadata from applications used for social networking into a CRM system. Such a system and method include includes obtaining, from applications used for social networking, metadata associated with users of the applications, analyzing the metadata from the applications to infer opportunities relationships for mapping clients, structures, and subject matter experts, and integrating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a CRM system to populate the CRM system. Such a method and system allows a CRM system to be quickly populated with metadata from the applications. As a result, the CRM system may become effective very quickly in targeting various customers.

In the specification and appended claims, the term “opportunities” is meant to be understood broadly as a complex record structure in a database, in which each of the opportunities captures a number of fields of metadata. In one example, the opportunities may include a business’s sales and/or interaction with current customers, future customers, or combinations thereof.

In the specification and appended claims, the term “application” is meant to be understood broadly as a computer program for an online community of users with a common interest who use a website or other technologies to communicate with each other and share information and resources for social networking. Further, the application may include metadata that maps relationships between users. In one

example, the relationships indicate the ways in which the users are connected through various social familiarities ranging from casual acquaintance to close familial bonds. In one example, the applications may be electronic mail (email) applications, instant messages (IM) applications, text messages (TM) applications, social network applications, blog applications, newsfeed applications, short message service (SMS) applications, other applications or combinations thereof.

In the specification and appended claims, the term “subject matter experts” is meant to be understood broadly as individuals that are specialists in a specific area. For example, a subject matter expert may be specialist in a specific product. In one example, a subject matter expert may be a user of an application used for social networking.

In the specification and appended claims, the term “structure” is meant to be understood broadly as an organizational arrangement of artifacts associated with an application or a CRM system. For example, a structure may include a physical structure of the applications. In one example, a structure may include a digital structure of the application’s metadata. In another example, the structure may include relationships for the users of the application. For example, the relationships for the users of the application may include client team structures, opportunity team structures, other structures, or combination thereof.

In the specification and appended claims, the term “metadata” is meant to be understood broadly as data that describes users of applications. In one example, the metadata is derived from interactions between the users of the applications. In another example, the metadata is based on historical patterns across the applications. In yet another example, the metadata is used to infer a social graph, subject matter experts, opportunities, relationships for mapping clients, contacts, or combinations thereof.

In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present systems and methods. It will be apparent, however, to one skilled in the art that the present apparatus, systems, and methods may be practiced without these specific details. Reference in the specification to “an example” or similar language means that a particular feature, structure, or characteristic described in connection with that example is included as described, but may not be included in other examples.

FIG. 1 is a diagram of an example of a system for integrating metadata from applications used for social networking into a CRM system, according to one example of principles described herein. As will be described below, an integrating system is in communication with a network to obtain, from applications used for social networking, metadata associated with users of the applications. The integrating system further analyzes the metadata from the applications to infer opportunities relationships for mapping clients, structures, and subject matter experts. Further, the integrating system integrates the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a CRM system to populate the CRM system.

As illustrated in FIG. 1, the system (100) includes a number of applications (108). As will be described in other parts of this specification, the applications (108) may be used for social networking. For example, the applications (108) may be email applications, IM applications, TM applications, social network applications, blog applications, newsfeed applications, or SMS applications. In one example, a user device (102) allows a user to access the applications (108). As a result, the user is able to share

information with other users using the applications (108). As will be described below, the applications (108) may produce metadata about the user.

As illustrated in FIG. 1, the system (100) includes an integrating system (110). The integrating system (110) obtains, from the applications (108) used for social networking, metadata associated with users of the applications (108). In one example, the metadata from the applications (108) is derived from interactions between the users of the applications and based on historical patterns across the applications to infer a social graph, subject matter experts, opportunities, relationships for mapping clients, contacts, or combinations thereof.

The integrating system (110) further analyzes the metadata from the applications (108) to infer the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts. In one example, the integrating system (110) analyzes the metadata from the applications (108) via data mining.

Further, the integrating system (110) integrates the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a CRM system (112) to populate the CRM system (112). In this example, the CRM system (112) may be a new CRM system that is absent of this information. By integrating this information into the CRM system (112), the CRM system (112) is quickly populated with metadata from the applications (108). As a result, the CRM system (112) may become effective very quickly for targeting various customers.

Further, the integrating system (110) updates the CRM system (112) based on modifications made by the users in the applications (108). In one example, the integrating system (110) updates the CRM system based on the modifications made by the users, via the user device (102), to the applications (108) by updating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts in the CRM system (112). More information about the integrating system (112) will be described in later parts of this specification.

While this example has been described with reference to the integrating system being located over the network, the integrating system may be located in any appropriate location. For example, the integrating system may be located in a user device, a database, a CRM system, other locations, or combinations thereof.

FIG. 2 is a diagram of an example of a system for integrating metadata from applications used for social networking into a CRM system, according to one example of principles described herein. As mentioned above, all the information, such as metadata, that the integrating system of FIG. 1 obtains is stored in the CRM system.

As illustrated in FIG. 2, the system (200) includes a number of applications (208). In one example, the applications (208) may include email applications, IM applications, TM applications, social network applications, blog applications, newsfeed applications, SMS applications, other applications, or combinations thereof.

In one example, the applications (208) may include metadata (202). In this example, the metadata (202) includes patterns, social graphs, relationships, structures, or combinations thereof of the users of the applications (208).

In one example, the metadata (202) for the patterns may indicate that most users access the applications (208) during a specific time. In another example, the patterns indicate that if user A is using the applications (208) an average of three



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other users will also use the applications (208). Further, the patterns may be historical patterns, current patterns, or predicted future patterns.

In one example, the metadata (202) for the social graphs may include a visual representation of relationships of the user of the applications (208). For example, a social graph may indicate that user A is connected to user B. As a result, the social graph may be used for mapping relationships for clients, subject matter experts, other users, or combinations thereof.

In one example, the metadata (202) for the structures may include a physical structure of the applications. In another example, the metadata (202) for the structures may include a digital structure of the applications. In yet another example, the metadata (202) for the structures may include structures for relationships for the users of the applications (208). For example, client team structures or opportunity team structures.

As illustrated in FIG. 2, the system (200) includes an integrating system (210). The integrating system (210) includes a number of engines (204). The engines (204) refer to a combination of hardware and program instructions to perform a designated function. Each of the engines (204) may include a processor and memory. The program instructions are stored in the memory and cause the processor to execute the designated function of the engine. As illustrated, the integrating system (210) includes an obtaining engine (204-1), an analyzing engine (204-2), an integrating engine (204-3), and an updating engine (204-4).

In one example, the obtaining engine (204-1) obtains, from applications (208) used for social networking, the metadata (202) associated with users of the applications (208). The obtaining engine (204-1) may obtain the metadata (202) for all the users of the applications (208). Alternatively, the obtaining engine (204-1) may obtain the metadata (202) for specific users of the applications (208).

In keeping with the given example, the analyzing engine (204-2) analyzes the metadata (202) from the applications (208) to infer opportunities relationships for mapping clients, structures, and subject matter experts. As mentioned above, the opportunities represent a complex record structure in the CRM system, in which each of the opportunities is associated with a number of fields of the metadata (202). In one example, the subject matter experts may be users that are specialists in a specific area. For example, a specialist in a specific product.

Once the metadata is analyzed, the integrating engine (204-3) then integrates the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a CRM system (212) to populate the CRM system (212). As illustrated in FIG. 2, the CRM system (212) includes the opportunities (214), the relationships for the clients (216), the structures (220), and the subject matter experts (218).

In one example, the CRM system (212) is used as a model for managing a business's interactions with current and future customers. The CRM system (212) uses techniques and methods, such as the integrating system (210), to organize, automate, and synchronize sales, for marketing, customer service, and technical support. In one example, the integrating system (210) monitors the applications (208) to gather information to better target various customers. For example, current customers and potentially future customers.

In one example, the CRM system's strategy is based around customer engagement and interactions, with transactions being a byproduct. In this example, the CRM system

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(212) is a back-end process and system for managing customer relationships and data in an efficient and process-centric way. The CRM system (212) is able to understand the business's challenges that are to be solved, and then solving the challenges. Further, the CRM system (212) may be one component of developing a social or collaborative business, both internally and externally.

The updating engine (204-4) updates the CRM system (212) based on modifications made by the users in the applications (208). The updating engine (204-4) updates the CRM system (212) based on the modifications made by the users to the applications (208) by updating the opportunities (214), the relationships for the clients (216), the structures (220), and the subject matter experts (218) in the CRM system (212).

An example of a client and opportunity membership scenario will now be described with reference to FIG. 2. For this scenario, the integrating system (210) analyzes the metadata (202), such as all the memberships of particular communities, for specific metadata that would be of interest to CRM system (212). For example, the integrating system (210) analyzes the metadata (202) for specific client names and/or products and uses the membership lists of these communities to infer an equivalent relationship in a CRM system (212). For example, the integrating system (210) categorizes the particular communities as being product related. In this example, their memberships will map to opportunity team structures or customer related. In the case for the customer related, their memberships will map to client team structures.

The integrating system (210) uses this information to pre-populate a new CRM system with a relatively useful client hierarchy and team structure along with a fairly accurate set of initial opportunities based on existing communities discussing product related issues. More significantly, both of these CRM artifacts are now populated with relevant team structures, which provide a starting point for re-use in creation of the clients or opportunities going forward.

An example for expert identification will now be described with reference to FIG. 2. Using the set of CRM tagged social artifacts as described above, the integrating system (210) can use classical data mining techniques to identify a set of subject matter experts, be it around products, implementation, or selling. These profiles can then be used to assemble client and opportunity memberships by applying a profile for each of these artifacts. For example an opportunity template could include a project manager, a tech sales representative, and a developer. The integrating system (210) is then used to populate the expert structure in a CRM system (212). Further, examples may include pre-populating and creating communities, activities, IM groups, email realms, foundational reporting analytics and collectively wiring the relationships between these latter pieces so that the CRM system's context is realized in a plurality of parts.

In another example, a mature CRM system may be of interest to integrate the metadata (202) into. In this example, the integrating system (210) may use the updating engine (204-4) to update the opportunities, relationships for clients, subject matter experts, and structures in the mature CRM system accordingly.

FIG. 3 is a flowchart of an example of a method for integrating metadata from applications used for social networking into a CRM system, according to one example of principles described herein. In one example, the method (300) may be executed by the integrating system (100) of FIG. 1. In other examples, the method (300) may be

executed by other systems (i.e. system **500** and system **600**). In this example, the method (**300**) includes obtaining (**301**), from applications used for social networking, metadata associated with users of the applications, analyzing (**302**) the metadata from the applications to infer opportunities relationships for mapping clients, structures, and subject matter experts, and integrating (**303**) the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into CRM system to populate the CRM system.

As mentioned above, the method (**300**) includes obtaining (**301**), from applications used for social networking, metadata associated with users of the applications. As mentioned above, the metadata from the applications is derived from interactions between the users of the applications, based on historical patterns across the applications, and used to infer a social graph, subject matter experts, the opportunities, clients, relationships for mapping clients, contacts, or combinations thereof. As a result, the metadata includes patterns, social graphs, relationships for mapping clients, structures, or combinations thereof of the users of the applications.

As mentioned above, the method (**300**) includes analyzing (**302**) the metadata from the applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts. As mentioned above, the opportunities represent a complex record structure in the CRM system and each of the opportunities is associated with a number of fields of the metadata.

In one example, data mining may be used to analyze the metadata. Data mining may be used to identify metadata that specific words, terms, phrases, or combinations thereof to infer opportunities, relationships for mapping clients, structures, and subject matter experts.

As mentioned above, the method (**300**) includes and integrating (**303**) the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into CRM system to populate the CRM system. As mentioned above, a CRM system is used as a model for managing a business's interactions with current and future customers. The CRM system uses techniques and methods to organize, automate, and synchronize sales, for marketing, customer service, and technical support. In one example, the CRM system may be a classical CRM system that monitors sources such as current customers and potentially future customers to gather information to better target various customers via applications. The classical CRM system traditionally includes a one-way communication between a business and the customer.

In another example the CRM system may be a social CRM system that monitors applications such as social media applications. In this example, the social CRM system's strategy is based around customer engagement and interactions, with transactions being a byproduct. In one example, the Social CRM system may use a philosophy and a business strategy, supported by a technology platform, business rules, workflow, processes and social characteristics, designed to engage the customer in a collaborative conversation in order to provide mutually beneficial value in a trusted and transparent business environment. Further, the social CRM system includes applications in marketing, customer service and sales, including peer-to-peer customer support, idea management, market research, product launch, brand reputation management.

In this example, the social CRM system is a back-end process and system for managing customer relationships and data in an efficient and process-centric way. The social CRM system is able to understand the business's challenges that

are to be solved and then solve the business's challenges. Further, the social CRM system may be one component of developing a social or collaborative business, both internally and externally.

Regardless of if the CRM system is a classical CRM system or a social CRM system, the method (**300**) integrates the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into CRM system to populate the CRM system. In one example, the integrating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into CRM system to populate the CRM system includes loading the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into CRM system's memory.

FIG. 4 is a flowchart of an example of a method for integrating metadata from applications used for social networking into a CRM system, according to one example of principles described herein. In one example, the method (**400**) may be executed by the integrating system (**100**) of FIG. 1. In other examples, the method (**400**) may be executed by other systems (i.e. system **500** and system **600**). In this example, the method (**400**) includes obtaining (**401**), from applications used for social networking, metadata associated with users of the applications, analyzing (**402**) the metadata from the applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts, integrating (**403**) the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into CRM system to populate the CRM system, and updating (**404**) the CRM system based on modifications made by the users in the applications.

As mentioned above, the method (**400**) includes updating (**404**) the CRM system based on modifications made by the users in the applications. In one example, the method (**400**) updates the CRM system based on the modifications made by the users to the applications by updating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts in the CRM system.

In one example, the integrating system of FIG. 1 obtains the metadata from the application according to a factor such a time, an event, or other factors. If the integrating system of FIG. 1 determines the metadata obtained from the application has been modified, is new metadata, or is out of date, the CRM system is updated accordingly. This may include deleting some opportunities, some relationships for mapping the clients, some structures, and some subject matter experts in the CRM system and loading new opportunities, new relationships for mapping the clients, new structures, and new subject matter experts into the CRM system.

FIG. 5 is a diagram of an example of an integrating system, according to the principles described herein. The integrating system (**500**) includes an obtaining engine (**502**), an analyzing engine (**504**), and an integrating engine (**506**). In this example, the integrating system (**500**) also includes an updating engine (**508**). The engines (**502**, **504**, **506**, **508**) refer to a combination of hardware and program instructions to perform a designated function. Each of the engines (**502**, **504**, **506**, **508**) may include a processor and memory. The program instructions are stored in the memory and cause the processor to execute the designated function of the engine.

The obtaining engine (**502**) obtains from applications used for social networking, metadata associated with users of the applications. In one example, the metadata from the applications is derived from interactions between the users of the applications, based on historical patterns across the applications, and used to infer a social graph, subject matter

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experts, the opportunities, relationships for mapping clients, clients, contacts, or combinations thereof. Further, the applications may include email applications, IM applications, TM applications, social network applications, blog applications, newsfeed applications, SMS applications, other applications, or combinations thereof. In one example, the metadata includes patterns, social graphs, relationships for mapping clients, structures, or combinations thereof of the users of the applications.

The analyzing engine (504) analyzes the metadata from the applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts. In one example, the opportunities represent a complex record structure in the CRM system and each of the opportunities is associated with a number of fields of the metadata.

The integrating engine (506), integrates the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into CRM system to populate the CRM system. In one example, the integrating engine (506), integrates specific opportunities, specific relationships for mapping the clients, specific structures, and specific subject matter experts into CRM system to populate the CRM system.

The updating engine (508) updates the CRM system based on modifications made by the users in the applications. In one example, the updating engine (508) updates the CRM system based on the modifications made by the users to the applications by updating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts in the CRM system.

FIG. 6 is a diagram of an example of an integrating system, according to the principles described herein. In this example, the integrating system (600) includes processing resources (602) that are in communication with memory resources (604). Processing resources (602) include at least one processor and other resources used to process programmed instructions. The memory resources (604) represent generally any memory capable of storing data such as programmed instructions or data structures used by the integrating system (600). The programmed instructions shown stored in the memory resources (604) include a user interaction deriver (606), a metadata obtainer (608), a metadata analyzer (610), an opportunity integrator (612), a modification determiner (614), and a CRM system updater (616).

The memory resources (604) include a computer readable storage medium that contains computer readable program code to cause tasks to be executed by the processing resources (602). The computer readable storage medium may be tangible and/or physical storage medium. The computer readable storage medium may be any appropriate storage medium that is not a transmission storage medium. A non-exhaustive list of computer readable storage medium types includes non-volatile memory, volatile memory, random access memory, write only memory, flash memory, electrically erasable program read only memory, or types of memory, or combinations thereof.

The user interaction deriver (606) represents programmed instructions that, when executed, cause the processing resources (602) to derive interactions between the users of the applications and based on historical patterns across the applications to infer a social graph, subject matter experts, the opportunities, relationships for mapping clients, clients, contacts, or combinations thereof. The metadata obtainer (608) represents programmed instructions that, when executed, cause the processing resources (602) to obtain,

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from applications used for social networking, metadata associated with users of the applications.

The metadata analyzer (610) represents programmed instructions that, when executed, cause the processing resources (602) to analyze the metadata from the applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts. The opportunity integrator (612) represents programmed instructions that, when executed, cause the processing resources (602) to integrating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into CRM system to populate the CRM system.

The modification determiner (614) represents programmed instructions that, when executed, cause the processing resources (602) to determine modifications made by the users in the applications. The CRM system updater (616) represents programmed instructions that, when executed, cause the processing resources (602) to update the CRM system based on modifications made by the users in the applications.

Further, the memory resources (604) may be part of an installation package. In response to installing the installation package, the programmed instructions of the memory resources (604) may be downloaded from the installation package's source, such as a portable medium, a server, a remote network location, another location, or combinations thereof. Portable memory media that are compatible with the principles described herein include DVDs, CDs, flash memory, portable disks, magnetic disks, optical disks, other forms of portable memory, or combinations thereof. In other examples, the program instructions are already installed. Here, the memory resources can include integrated memory such as a hard drive, a solid state hard drive, or the like.

In some examples, the processing resources (602) and the memory resources (604) are located within the same physical component, such as a server, or a network component. The memory resources (604) may be part of the physical component's main memory, caches, registers, non-volatile memory, or elsewhere in the physical component's memory hierarchy. Alternatively, the memory resources (604) may be in communication with the processing resources (602) over a network. Further, the data structures, such as the libraries, may be accessed from a remote location over a network connection while the programmed instructions are located locally. Thus, integrating system (600) may be implemented on a user device, on a server, on a collection of servers, or combinations thereof.

The integrating system (600) of FIG. 6 may be part of a general purpose computer. However, in alternative examples, the integrating system (600) is part of an application specific integrated circuit.

The preceding description has been presented to illustrate and describe examples of the principles described. This description is not intended to be exhaustive or to limit these principles to any precise form disclosed. Many modifications and variations are possible in light of the above teaching.

The flowchart and block diagrams in the figures illustrate the architecture, functionality, and operations of possible implementations of systems, methods, and computer program products. In this regard, each block in the flowchart or block diagrams may represent a module, segment, or portion of code, which has a number of executable instructions for implementing the specific logical function(s). It should also be noted that, in some alternative implementations, the functions noted in the block may occur out of the order noted in the figures. For example, two blocks shown in succession

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may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. It will also be noted that each block of the block diagrams and/or flowchart illustration and combination of blocks in the block diagrams and/or flowchart illustration, can be implemented by special purpose hardware-based systems that perform the specified functions or acts, or combinations of special purpose hardware and computer instructions.

The terminology used herein is for the purpose of describing particular examples, and is not intended to be limiting. As used herein, the singular forms “a,” “an” and “the” are intended to include the plural forms as well, unless the context clearly indicated otherwise. It will be further understood that the terms “comprises” and/or “comprising” when used in the specification, specify the presence of stated features, integers, operations, elements, and/or components, but do not preclude the presence or addition of a number of other features, integers, operations, elements, components, and/or groups thereof.

What is claimed is:

1. A method for integrating metadata from applications used for social networking into a customer relationship management (CRM) system, the method comprising:

obtaining, from applications used for social networking, metadata associated with users of the applications;

analyzing the metadata from the applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts;

integrating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a customer relationship management (CRM) system to populate the CRM system;

identifying potential customers based on integrated opportunities, relationships for mapping the clients, the structures, and the subject matter experts; and

managing interactions with current and target customers based on the integrated opportunities, relationships for mapping the clients, the structures, and the subject matter experts.

2. The method of claim 1, in which the metadata from the applications is derived from interactions between the users of the applications, based on historical patterns across the applications, and used to infer a social graph, the subject matter experts, the opportunities, the relationships for mapping the clients, contacts, or combinations thereof.

3. The method of claim 1, in which the applications comprises electronic mail (email) applications, instant messages (IM) applications, text messages (TM) applications, social network applications, blog applications, newsfeed applications, or short message service (SMS) applications.

4. The method of claim 1, in which the metadata comprises patterns, social graphs, the relationships for mapping the clients, the structures, or combinations thereof of the users of the applications.

5. The method of claim 1, further comprising updating the CRM system based on modifications made by the users in the applications.

6. The method of claim 5, in which updating the CRM system based on the modifications made by the users to the

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applications comprises updating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts in the CRM system.

7. The method of claim 1, in which the opportunities represent a complex record structure in the CRM system and each of the opportunities is associated with a number of fields of the metadata.

8. A method for integrating metadata from applications used for social networking into a customer relationship management (CRM) system, the method comprising:

accessing a social networking application via a user device;

accessing metadata on the social networking application, wherein the metadata:

comprises:

patterns;

social graphs of users of the application;

relationships;

structures of the application; and

is derived from:

interactions between users of the application; and

historical patterns across the application;

determining, from the metadata, a subset of the metadata to infer opportunities, relationships for mapping clients, structures, and subject matter experts;

determining from the subset of the metadata:

when a user accesses the application;

how many other users access the application when the user accesses the application;

analyzing the metadata from the applications to infer:

complex record opportunities that include multiple fields of metadata and that comprise an entity's interactions with customers,

relationships for mapping clients,

structures, and

subject matter experts;

integrating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a customer relationship management (CRM) system to populate the CRM system;

organizing, automating, and synchronizing sales, marketing, customer service and technical support for an organization based on the integrated opportunities, relationships for mapping the clients, the structures, and the subject matter experts;

identifying potential customers based on integrated opportunities, relationships for mapping the clients, the structures, and the subject matter experts; and

managing interactions with current and target customers based on the integrated opportunities, relationships for mapping the clients, the structures, and the subject matter experts.

9. The method of claim 8, wherein the patterns are predicted future patterns.

\* \* \* \* \*

# **EXHIBIT 11**



**DESMARAIS** LLP

# **Zillow Infringes U.S. Patent No. 10,115,168 (Arroyo)**



# U.S. Patent No. 10,115,168 (Arroyo)

(12) <b>United States Patent</b> <b>Arroyo et al.</b>	(10) <b>Patent No.:</b> <b>US 10,115,168 B2</b> (45) <b>Date of Patent:</b> <b>Oct. 30, 2018</b>
(54) <b>INTEGRATING METADATA FROM APPLICATIONS USED FOR SOCIAL NETWORKING INTO A CUSTOMER RELATIONSHIP MANAGEMENT (CRM) SYSTEM</b>	USPC ..... 707/741, 803 See application file for complete search history.
(71) Applicant: <b>International Business Machines Corporation</b> , Armonk, NY (US)	(56) <b>References Cited</b>  U.S. PATENT DOCUMENTS
(72) Inventors: <b>Jorge A. Arroyo</b> , Carmel, IN (US); <b>Stephen P. Kruger</b> , Dublin (IE); <b>Luciano Silva</b> , Apex, NC (US); <b>Patrick J. O'Sullivan</b> , Dublin (IE)	7,716,159 B2 * 5/2010 Mall ..... G06Q 30/02 705/7.32 8,731,918 B2 * 5/2014 Wasserblat ..... G10L 15/26 704/231 2007/0100739 A1 * 5/2007 Cui ..... G06Q 30/08 705/37 2008/0147478 A1 * 6/2008 Mall ..... G06Q 30/02 705/14.4 2008/0301549 A1 * 12/2008 Czudak ..... G06F 17/30265 715/274 2011/0125793 A1 * 5/2011 Erhart ..... G06Q 30/02 707/776
(73) Assignee: <b>INTERNATIONAL BUSINESS MACHINES CORPORATION</b> , Armonk, NY (US)	(Continued)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 758 days.	OTHER PUBLICATIONS
(21) Appl. No.: <b>14/639,537</b>	List of IBM Patents or Patent Applications Treated as Related, May 27, 2015, pp. 1-2.
(22) Filed: <b>Mar. 5, 2015</b>	<i>Primary Examiner</i> — Phong H Nguyen
(65) <b>Prior Publication Data</b>  US 2015/0332289 A1 Nov. 19, 2015	(74) <i>Attorney, Agent, or Firm</i> — Fabian VanCott; Steven L. Nichols
<b>Related U.S. Application Data</b>	(57) <b>ABSTRACT</b>
(63) Continuation of application No. 14/281,042, filed on May 19, 2014, now Pat. No. 9,626,727.	Integrating metadata from applications used for social networking into a customer relationship management (CRM)

1. A method for integrating metadata from applications used for social networking into a customer relationship management (CRM) system, the method comprising:

- obtaining, from applications used for social networking, metadata associated with users of the applications;
- analyzing the metadata from the applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts;
- integrating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a customer relationship management (CRM) system to populate the CRM system;
- identifying potential customers based on integrated opportunities, relationships for mapping the clients, the structures, and the subject matter experts; and
- managing interactions with current and target customers based on the integrated opportunities, relationships for mapping the clients, the structures, and the subject matter experts.

# U.S. Patent No. 10,115,168 (Arroyo) – Claim 1

## 1. A method for integrating metadata from applications used for social networking into a customer relationship management (CRM) system, the method comprising:

### What is Zillow Premier Agent?

Zillow Premier Agent is designed to connect agents with active buyers and sellers to help them grow their business, as well as providing them with tools and resources to help them convert those buyers and sellers into lasting clients.

### What does it mean to be a Zillow Premier Agent?

Agents who advertise with Zillow Group are called Zillow Premier Agents. They receive branding and exposure across the largest online real estate network. This means they are appearing prominently where home shoppers are searching on Zillow and Trulia (as well as StreetEasy in New York City ZIP codes) and are receiving leads when buyers and sellers choose to contact an agent. In some markets, they will also receive live connections to home shoppers when buyers and sellers request the help of an agent through these sites.

<https://www.zillow.com/agent-resources/blog/prioritize-clients-with-new-my-agent-benefits/#buyer-activity-email>

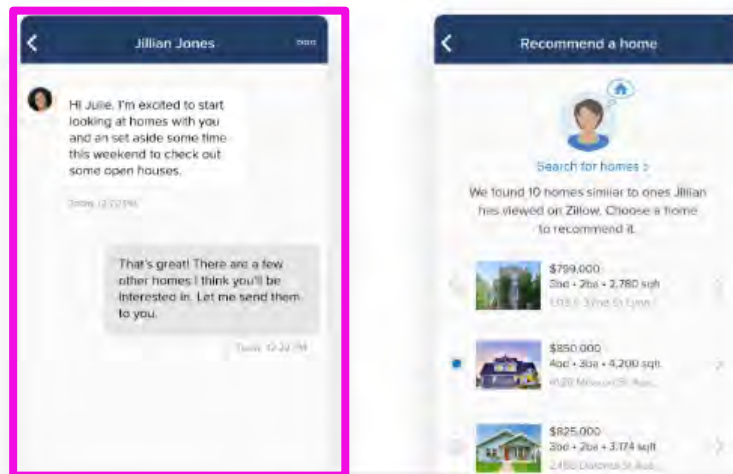
In the specification and appended claims, the term “**metadata**” is meant to be understood broadly as **data that describes users of applications**. In one example, the metadata is derived from interactions between the users of the applications. In another example, the metadata is based on historical patterns across the applications. In yet another example, the metadata is used to infer a social graph, subject matter experts, opportunities, relationships for mapping clients, contacts, or combinations thereof. (Arroyo at 5:27-35).

# U.S. Patent No. 10,115,168 (Arroyo) – Claim 1

obtaining, from applications used for social networking, metadata associated with users of the applications;

## Keep the conversation going with AI-powered home recommendations

Make your text messages stand out with the power of artificial intelligence. When you text a client through the Zillow Premier Agent App, you can tap into a list of homes they might like, based on their Zillow or Trulia activity.



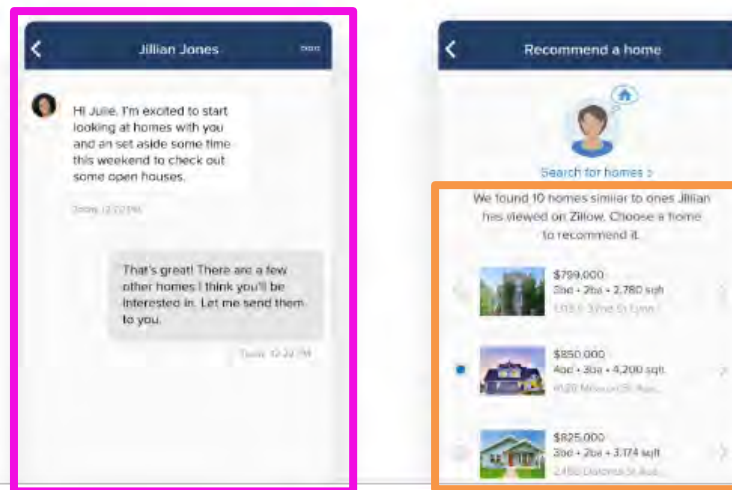
<https://www.zillow.com/agent-resources/blog/prioritize-clients-with-new-my-agent-benefits/#buyer-activity-email>

# U.S. Patent No. 10,115,168 (Arroyo) – Claim 1

analyzing the metadata from the applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts;

## Keep the conversation going with AI-powered home recommendations

Make your text messages stand out with the power of artificial intelligence. When you text a client through the Zillow Premier Agent App, you can tap into a list of homes they might like, based on their Zillow or Trulia activity.



<https://www.zillow.com/agent-resources/blog/prioritize-clients-with-new-my-agent-benefits/#buyer-activity-email>

# U.S. Patent No. 10,115,168 (Arroyo) – Claim 1

analyzing the metadata from the applications to infer opportunities, relationships for mapping clients, structures, and subject matter experts;

Know all the ways to extend your valuable My Agent relationships

You can only see the buyer activity of clients with whom you have an active My Agent relationship, so it's essential to extend those relationships to take advantage of the buyer activity digest.

You automatically get a 30-day My Agent relationship with every connection you receive from us. During this period, you'll appear as the only buyer's agent on listings they view and the home search emails they receive from us. You'll gain insight into homes they view, save and search for on Zillow through the app and CRM — plus they'll appear in your new buyer activity email when they've been active in the past 24 hours.

To extend these benefits beyond the initial 30 days, simply text your client through the app or CRM. Every time there is a back-and-forth exchange, the relationship renews for another 30 days. Keep up this communication to maintain these valuable benefits all the way to closing.

<https://www.zillow.com/agent-resources/blog/prioritize-clients-with-new-my-agent-benefits/#buyer-activity-email>



# U.S. Patent No. 10,115,168 (Arroyo) – Claim 1

analyzing the metadata from the applications to infer **opportunities**, **relationships** for **mapping** **clients**, **structures**, and **subject matter experts**;

## Lead types and distribution

There are three primary types of leads you receive as a Zillow Premier Agent

- 1 **Direct contacts** Leads who select you to contact specifically
- 2 **Connections:** Agent-ready leads we connect you with live via telephone
- 3 **Nurture leads:** Leads who aren't ready to speak with an agent

### Direct contacts

Home buyers and sellers on Zillow and Trulia can select a specific agent to contact. In scenarios where a lead selects you, we send you their contact information. Since these leads selected you specifically, they're yours from the start.

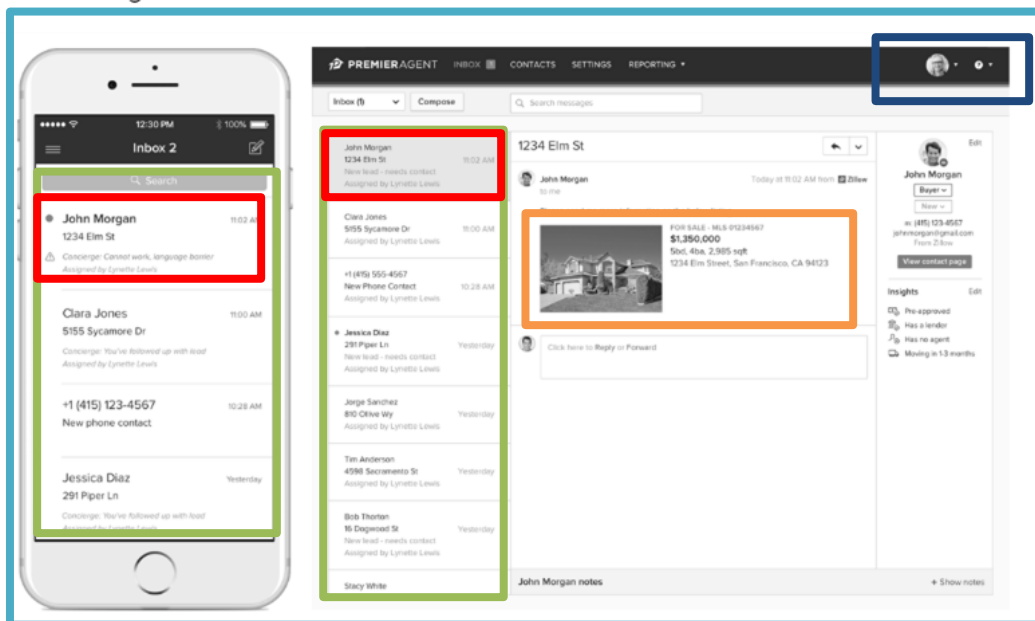
<https://www.zillow.com/agent-resources/blog/prioritize-clients-with-new-my-agent-benefits/#buyer-activity-email>

“In another example, the structure may include **relationships for the users of the application**. For example, the relationships for the users of the application may include client team structures, opportunity team structures, other structures, or combination thereof.” (Arroyo at 5:23-26).

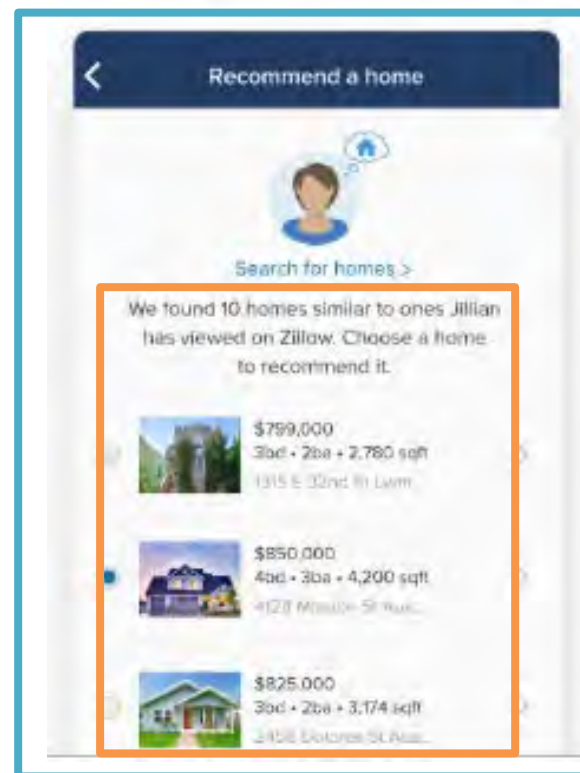
# U.S. Patent No. 10,115,168 (Arroyo) – Claim 1

integrating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a customer relationship management (CRM) system to populate the CRM system;

visible in your lead inbox. You can access your lead inbox on your mobile phone with the **Premier Agent App**, or on your computer, giving you a seamless experience, whether you're out at showings or in the office.



<https://www.zillow.com/agent-resources/training/using-premier-agent-app-inbox/real-estate-crm-with-zillow-app/>



<https://www.zillow.com/agent-resources/blog/prioritize-clients-with-new-my-agent-benefits/#buyer-activity-email>

# U.S. Patent No. 10,115,168 (Arroyo) – Claim 1

integrating the opportunities, the relationships for mapping the clients, the structures, and the subject matter experts into a customer relationship management (CRM) system to populate the CRM system;

If you oversee a team of agents, the Zillow Premier Agent CRM also offers powerful tools to help you get the right lead to the right agent.

<https://www.zillow.com/agent-resources/training/using-premier-agent-app-inbox/real-estate-crm-with-zillow-app/>

## Connections and Other Leads

These rules cover all other kinds of leads, including connections we send you live by phone, leads who contact you directly and leads we've delivered for you to nurture.

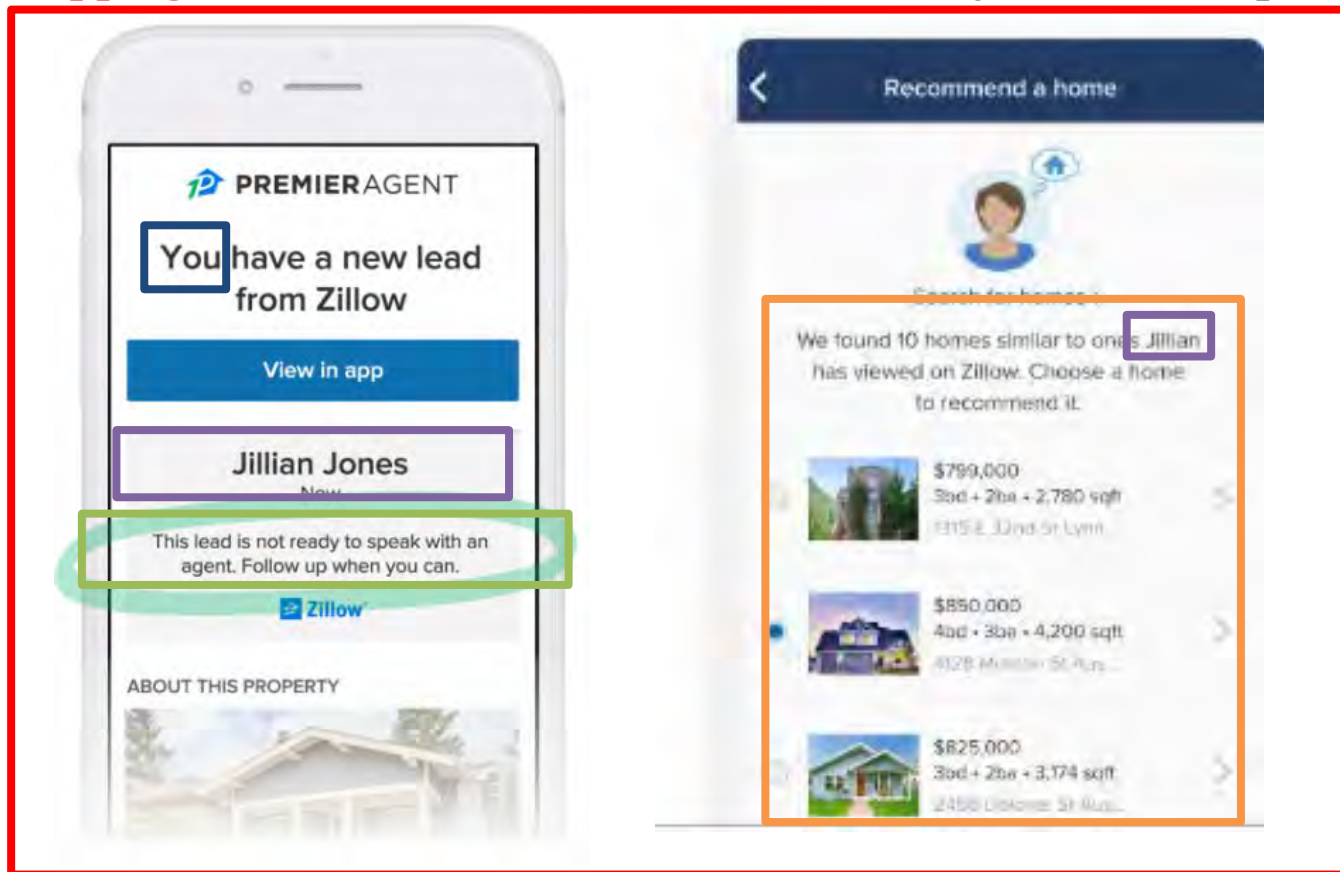
These rules are based on any combination of the following attributes:

- Location: Choose a ZIP code or city
- Price: Route based on the for-sale value on the active listing
- Lead type: Route based on how the lead was generated (all, profile, buyer or seller)
- MLS number: Enter up to 10 MLS IDs
- Day/Time: Customize routing based on team members' availability

<https://www.zillow.com/agent-resources/training/tools-for-agent-teams/lead-routing-teams/>

# U.S. Patent No. 10,115,168 (Arroyo) – Claim 1

identifying potential customers based on **integrated opportunities**, **relationships** for mapping the **clients**, the **structures**, and the **subject matter experts**; and



<https://www.zillow.com/agent-resources/blog/pa4-more-leads-more-control/>

<https://www.zillow.com/agent-resources/blog/prioritize-clients-with-new-my-agent-benefits/#buyer-activity-email>

# U.S. Patent No. 10,115,168 (Arroyo) – Claim 1

**managing interactions with current and target customers based on the integrated opportunities, relationships for mapping the clients, the structures, and the subject matter experts.**

If you have a free agent account, you have access to your own personal system that can help you manage your real estate leads: the Premier Agent CRM. This CRM was built to help busy agents face the challenges of organizing, tracking and responding quickly to leads — anytime, anywhere.

You can download the mobile app for iOS or Android [here](#). To access these features on your desktop, [sign in to your agent account](#) and click on **Inbox**.

<https://www.zillow.com/agent-resources/training/using-premier-agent-app-inbox/get-an-overview-of-the-premier-agent-app-and-inbox/>



# U.S. Patent No. 10,115,168 (Arroyo) – Claim 4

## 4. The product of claim 1, in which the metadata comprises **patterns**, social graphs, the relationships for mapping clients, the structures, or combinations thereof of the users of the applications.

Another way of modeling similar homes is to utilize the user-item engagement (“collaborative”) data, such as implicit user feedback (e.g., clicks and saves) as in the case of the collaborative filtering, the listing embedding method used by Airbnb [1], and the product embedding method developed by Yahoo [2]. The intuition behind is that homes clicked by similar users are similar.

<https://www.zillow.com/tech/embedding-similar-home-recommendation/>

One of the core methods used within Zillow’s home recommendation engine is collaborative filtering. There are several ways collaborative filtering can be implemented. Due to the lack of explicit user ratings here at Zillow, we use matrix factorization with implicit feedback [1]. This method starts by constructing user-item

Due to the lack of explicit ratings for individual homes from our customer, we have to rely on implicit feedback, e.g. how long customers spend on the details page of each home they visited. To process this data we use the method of Implicit Matrix Factorization (IMF) for collaborative filtering [1]. To use the IMF method we build a

<https://www.zillow.com/tech/visualizing-matrix-factorization/>

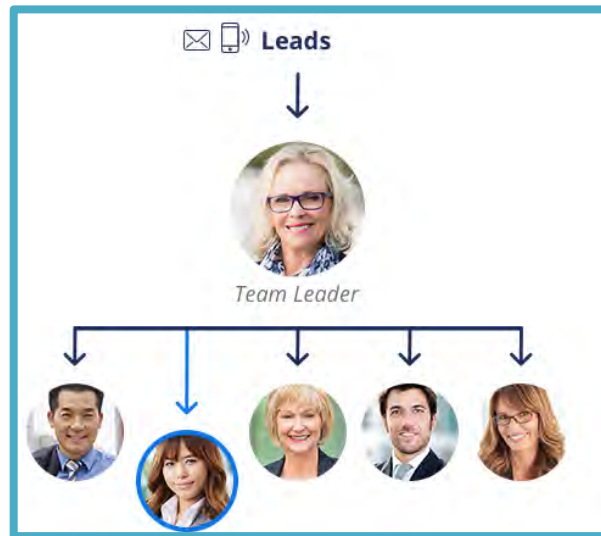


4. The product of claim 1, in which the metadata comprises patterns, **social graphs**, the relationships for mapping clients, the structures, or combinations thereof of the users of the applications.

## Naming your team and adding members

Once you've created a team profile, you're now the team leader and can name your team, start inviting agents to become team members, and set up routing rules to send the right leads to the right agents. To set your team name, Click on **Add team name** and enter your team name.

<https://www.zillow.com/agent-resources/training/tools-for-agent-teams/create-team-profile/>



## Get the right lead to the right agent

- Set lead routing rules by price, location and type to quickly deliver incoming leads to the right team members.
- Broadcast phone calls to your team members in real time to increase your team's lead response rate.
- Monitor your team's performance by tracking lead volume, status and response time.

[Get started](#)

<https://premieragent.zillow.com/products/teams/>